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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2416
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2417
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 2417
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2417
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2417
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2418
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2419
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2423
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2423
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2423
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 2424

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
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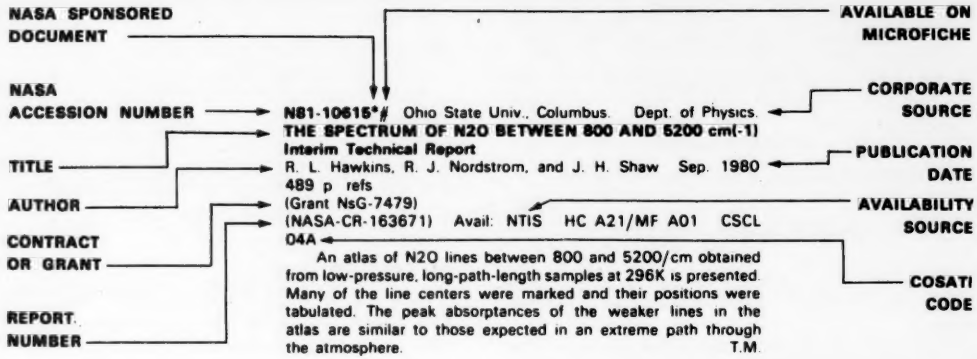
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N81-10615*# Ohio State Univ., Columbus. Dept. of Physics.
CORPORATE SOURCE
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
Interim Technical Report
TITLE
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980
PUBLICATION DATE
AUTHOR
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REPORT NUMBER
An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere. T.M.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, SMOOTHING OF FLIGHT TEST AND ACCIDENT DATA

J.C. Wang, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Mechanical Engineering, *Washington Sq., San Jose, California* 95192 (NCC 2-123)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0002, TRANSONIC COMPRESSOR INVESTIGATIONS

R.P. Shreeve, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (DN898081)

To investigate the flow phenomena in an axial transonic compressor stage to establish more precise methods for predicting performance and non-steady effects.

Carry-out tests using an impulse-type transonic compressor and develop and apply methods of measuring properties of the flow through the blade rows.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0003, ENGINEERING AND SPARE PART SUPPORT TEST OF GROUND MOBILITY SYSTEMS (DA0E3876)

J.P. Forsyth, Vehicle Systems Development Corp., *1251 W. 9th St., Upland, California* 91786 (DA0G0410; DAAK51-79-D-0001)

Provide contractor engineering support and spare part supply as necessary for concept evaluation tests of the two sets of a helicopter ground mobility system procured under an earlier contract.

Contract for as-required technical services and spare parts at negotiated rates and prices, and issue delivery orders as necessary up to a specified maximum dollar value in FY79 and FY80.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0004, INLET FLOW DISTORTION IN TURBO MACHINERY

B.S. Seidel, University of Delaware, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Newark, Delaware* 19711 (NAG 3-121)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0005, INTERACTIVE AIRCRAFT FLIGHT CONTROL AND AEROELASTIC STABILIZATION

T.A. Weisshaar, Purdue University, Graduate School, *Executive Bldg., West Lafayette, Indiana* 47907 (NAG 1-157)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0006, MULTIPLE-LEVEL TECHNIQUES FOR COMPUTATIONAL FLUID DYNAMICS

D.R. McCarthy, Purdue University, School of Science, Dept. of Mathematics, *Executive Bldg., West Lafayette, Indiana* 47907 (NAG 1-116)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0007, GRADUATE RESEARCH IN AERONAUTICAL FLIGHT TEST TECHNIQUES

W.G. Schweikhard, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NCC 4-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center

1.0008, REGENERATIVE ENGINE ANALYSIS

P.W. Vinson, General Electric Co., *1000 Western Ave., Lynn, Massachusetts* 01901 (DA0G0501; DAAK51-79-C-0055)

The objectives are to identify promising heat exchanger concepts, and to conduct a preliminary design and analysis of a fuel efficient regenerative turboshaft engine suitable for helicopter application.

The effort will be conducted in two phases, as follows: a. Engine parametric and heat exchanger design analysis. b. Regenerative engine preliminary design and configuration definition.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0009, A TECHNOLOGY SURVEY OF THE RECIPROCATING AIRCRAFT ENGINE LIQUID COOLING SYSTEM

R.W. Vangunst, University of Michigan, Ann Arbor Campus, Graduate School, *Rackham Bldg., Ann Arbor, Michigan* 48104 (NAG 3-168)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0010, AN ANALYTICAL STUDY OF THE STABILITY AND CONTROL OF VERTICAL TAKEOFF AND LANDING AIRSHIPS

H.C. Curtiss, Princeton University, School of Engineering & Applied Sciences, Dept. of Mechanical & Aerospace Engineering, *Box 430, Princeton, New Jersey* 08540 (NAG 2-98)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0011, NUMERICAL SIMULATION OF THE INTERACTION OF ACOUSTIC SOURCES WITH A JET

W. Grossmann, New York University, Washington Square & University College of Arts & Sciences, Dept. of Applied Science, *100 Washington Sq. E., New York, New York* 10003 (NAG 1-155)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0012, HYDROCARBON FUEL RESEARCH IN AN ADVANCED AIRCRAFT FUEL SYSTEM SIMULATOR

R.P. Bradley, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451380)

Evaluate the overall performance and thermal stability limits of present operational and new candidate hydrocarbon jet fuels under simulated flight conditions to (l) determine the thermal limit and tolerance that these fuels provide when tested under various realistic flight profiles defined for aircraft systems under development and future aircraft, (2) examine the effect of various refining techniques, dissolved oxygen removal, and additives on fuel thermal stability, (3) provide a spectrum of fuel performance data that can be utilized by manufacturers in the design of engine and airframe systems, and (4) provide quantitative objectives to aid in the development of small-scale test methods.

This three-year analytical and experimental program consists of three phases: (1) evaluate, categorize and prioritize by reference to existing aircraft the internal and external data required to produce effective vehicle performance; (2) establish correlation parameters between test and full-scale levels; and (3) execute the procedure for performance prediction and verify the correlation parameters via wind tunnel testing and actual flight data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0013, VCE/CONTROLS ANALYSIS

L. Crawford, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458050)

The primary objective of this program is to provide and utilize the analytical tools necessary to select variable geometry engine cycles and their controls.

This effort consists of developing under contract a low cycle fatigue life prediction program to predict component fatigue life. Included in the analysis will be effects of loading order, loading history, dwell time, material hysteresis as well as interactive effects of creep and plasticity. Each analysis will be verified through actual component testing as well as specimen testing to ensure accurate analytical techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0014, COMPUTER SIMULATION OF AUXILIARY POWER SYSTEMS

D. Gurecki, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF464410)

To obtain a computer model that, for a set of system parameters and input conditions for an auxiliary power system, results in accurate output results.

Formulation of computer models for various auxiliary power system components, if needed, and then the integration of them into one program which models the total auxiliary power system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0015, RESEARCH ON THE NOISE PRODUCED BY LARGE-SCALE STRUCTURE IN SUPERSONIC JETS

D.K. McLaughlin, Oklahoma State University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *Engineering N., Stillwater, Oklahoma* 74074 (NAG 1-159)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0016, AIRFRAME STRUCTURAL MECHANICS

L.W. Gause, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN133126)

Evolve engineering hypotheses for use in determining residual strength, fracture resistance and crack growth behavior in structures as means of ensuring structural integrity of naval aircraft.

Develop and verify crack growth models suitable for automated application for prediction of safe life and residual strength of metallic aircraft structures. Utilize and refine newly developed finite element methods in the localized analysis of typical structural assemblies. Apply advanced analytical procedures to develop and numerically quantify new strength and failure theories for composites, and design and perform experiments to demonstrate the various phenomena. Fabricate and test representative composite structural specimens after exposure to various environmental effects and/or subject to low velocity impact. Some of this work is being performed under contract, as reported in work units DG 602, B13, B14, B15, B16, B17, B18, B19, and B20.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Systems Command, Tech Admin.

1.0017, INVESTIGATION OF THE STRUCTURAL DEGRADATION AND PERSONNEL HAZARDS FROM HELICOPTER COMPOSITE STRUCTURE EXPOSED TO FIRE AND/OR EXPLOSIONS

R. Schiltz, Bell Helicopter Textron, *Hwy. 183, P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3859; DAAK51 79 C 0009)

To investigate the effects of fire/explosion on the structural integrity of composite materials and the personnel hazards (toxicity, smoke, etc.) resulting from same.

Following a literature and organizational survey to establish design guidelines and requirements, composite specimens will be fabricated and laboratory-tested to ascertain the structural degradation and resulting hazards (smoke, toxicity, etc.) to personnel when burning/explosion occurs. Based on the test findings, design guidelines will be developed to minimize the structural and personnel harmful effects due to composites exposed to post-crash, in-flight or explosive-induced fire. A computer program simulating the result of a helicopter composite structures fire will be demonstrated at ATL, Ft. Eustis, VA, upon completion of the technical effort.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0018, TRANSONIC UNSTEADY AERODYNAMICS FOR AEROELASTIC APPLICATIONS

H.K. Yoshihara, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF133090; F33615-78-C-3201)

This work unit supports the prediction of time-dependent loads, flutter, stability and control for flexible aircraft in transonic flight. At present, there are no analytical methods available which can be used in aircraft design, and reliance must be placed on proof-tests of extremely expensive aeroelastic wind tunnel models which yield very limited data. The objective of this effort is to improve the accuracy and realism of the design of flexible aircraft which fly in or through the transonic region. These improvements will also improve the cost and efficiency of the aircraft design process and improve flight safety.

A contractor will evaluate the aerodynamic equations for time-dependent flow over aircraft at transonic speeds. He will write computer programs to solve those equations by relaxation techniques and by time-integration techniques. The final phase

will be the application of the programs to a large-scale aircraft aeroelastic design problem.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, IN-HOUSE LABORATORY INDEPENDENT RESEARCH

R. Bhatt, Sigma Research Inc., *2952 George Washington Way, Richland, Washington* 99352 (DA0G3260; DAAK51-80-C-0023)

Conduct scientific program of basic research aimed at developing fundamental understanding of technical barriers or investigation of phenomena associated with component or material behavior in engines or drive trains for helicopter systems.

Analytical and experimental studies are conducted in-house with specimens and research equipment provided through Army-funded contracts to specifications defined by principal investigators. Effort is directed toward establishing baseline data for analytical models to predict life and behavior of graded ceramic shroud materials for hot sections and alumina-aluminum metal matrix composites for housings and engine component applications. Results will fill voids in current technology related to these new material systems.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Propulsion Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, MIRROR TECHNOLOGY DEVELOPMENT

E.K. Parks, University of Arizona, School of Engineering, Dept. of Aerospace & Mechanical Engineering, *Tucson, Arizona* 85721 (NAS 2-10903)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

2.0002, GEOLOGIC PROCESSES ON THE GALILEAN SATELLITES - IMPACT CRATERING, VOLCANISM AND TECTONISM

J.W. Head, Brown University, Graduate School, Dept. of Geological Sciences, *University Hall, Box 1883, Providence, Rhode Island* 02912 (NAGW 137)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, ANALYSIS OF SILICON SOLAR CELL AND NON-METALLIC MATERIALS (SPACE ENVIRONMENTAL EFFECTS DATA)

P.E. Wagner, University of Alabama in Huntsville, Graduate School, *Huntsville, Alabama* 35807 (NAS 8-34338)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

3.0002, COMPUTER ANALYSIS OF SHELLS AND COMPOSITES

D. Bushnell, Lockheed Missiles & Space Co. Inc., *3251 Hanover St., Palo Alto, California* 94304 (DF049730; F49620-77-C-0122)

AF function - advanced aerospace vehicles rely on highly efficient structure to achieve mission objectives. Deficiency - durability of advanced composite materials under operating environmental conditions is not well understood. In addition, a comprehensive guide to shell and panel structure modeling and analysis does not exist. Objective - this research program involves two task efforts. The objective is to determine both steady-state and transient behavior of a composite laminate under exposure to moisture and high thermal states while establishing, at the same time, a comprehensive analysis and structural modeling guide for shell and panel structures. How work contributes -results of this effort will result in improved understanding and methods for highly efficient flight vehicle structures.

Task 1 - analysis techniques for determining thermal and concentration profiles in a laminate will be combined with standard finite element analysis techniques. Resulting analysis capability will enable both transient and steady-state conditions to be treated. In addition, capability to handle viscoelasticity of matrix material will exist. With this tool, the major effort will be to investigate hydrothermal effects on residual stress, interlaminar stress and free edge stress behavior. Task 2 - two factors enter into the correct choice and effective use of a computer program for the analysis of structures of which thin shells and panels are significant parts: (1) the engineer must understand the physics of the problem well enough to be able to define his needs, and (2) the engineer must be informed which programs will satisfy these needs. This task addresses primarily the first factor. Emphasis will be placed on practical shell structures which may be stiffened, segmented, branched, discontinuous, and/or have complex composite wall constructions. Descriptions will be provided of some of the perculiarities of the behavior of shells, nonlinear behavior due to plasticity and large deflections, stress redistribution effects, stiffener and load eccentricity effects, bifurcation buckling, local versus general instability, imperfection sensitivity, low frequency bending versus high frequency extensional dynamic response, and fluid-shell interaction effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, EFFECTS OF LOW VELOCITY IMPACT ON STRENGTH CHARACTERISTICS OF COMPOSITE MATERIAL LAMINATES

H. Liebowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NAG 1-158)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0004, OHMIC CONTACTS, IRRADIATION EFFECTS AND THIN FILM GROWTH

P.H. Holloway, State University System of Florida, University of Florida, School of Engineering, Dept. of Materials Science & Engineering, *220 Black Hall, Gainesville, Florida* 32611 (NAG 1-154)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0005, CORROSION FATIGUE BEHAVIOR OF ALUMINUM ALLOYS

J.H. Mulhern, Materials Research Lab. Inc., *1 Service Rd., Glenwood, Illinois* 60425 (DA0B0677; DAAK10-79-C-0278)

This contract effort is the result of an unsolicited proposal which has been received from Materials Research Labortory, Inc. The objective of the work is to investigate the corrosion fatigue behavior of both 7000 series powder metallurgy and ingot metallurgy aluminum alloys in both inert and aggressive environments. The fatigue behavior will be determined by measurements of the fatigue crack growth rate at high delta K values. Such work is of extreme importance to helicopter structural parts, bridging and tank automotive structures.

The fatigue crack growth rate will be measured at various high delta K values from 7075-T6 and a new aluminum powder metallurgy alloy MA87. The variables to be examined are the environment, frequency, wave form, and stress intensity ratios.

The influence of these variables will be described in terms of fracture mechanics paramaters.

SUPPORTED BY U.S. Dept. of Defense, Armament Research & Development Command, Fire Control & Small Caliber Weapon Systems Lab.

3.0006, CHARACTERIZATION OF MECHANICAL, THERMAL AND WEAR PROPERTIES OF TI-RICH METALLIC GLASSES 15098-MS

B.C. Giessen, Northeastern University, School of Liberal Arts, Dept. of Chemistry, *360 Huntington Ave., Boston, Massachusetts* 02115 (DA0F9251; DAAG29-78-G-0137)

To study the mechanical and thermal properties of ternary and quarternary amorphous alloys with compositions involving between 50 and 80 atomic percent of titanium. Relevance - the research has potential application to a wide variety of bearing and faying surfaces, where wear, galling, fretting, and corrosion have been problems in the past in helicopter hardness and a wide range of components of ground vehicles. Hard facings for drilling and construction machinery are other possible applications.

The research is to include the following: samples are to be produced by rapid liquid quenching of the corresponding liquid; X-ray diffraction and differential scanning calorimetry will be used to characterize the materials in the quenched state and after various stages of annealing; mechanical properties, including bulk, shear, and Young's moduli, hardness, tensile, and wear behavior will be measured for the various structures and compositions produced.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0007, INTERACTION OF BIOTA AND ATMOSPHERE - THE GEOLOGICAL RECORD

J.C. Walker, University of Michigan, Ann Arbor Campus, Graduate School, *Rackham Bldg., Ann Arbor, Michigan* 48104 (NAGW 176)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

3.0008, A MICROSTRUCTURAL STUDY OF PLASMA-SPRAYED THERMAL BARRIER COATINGS

H. Herman, State University of New York, Stony Brook Campus, School of Engineering & Applied Sciences, Dept. of Materials Science & Engineering, *Stony Brook, New York* 11794 (NAG 3-164)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0009, THEORETICAL INVESTIGATION OF CREEP CRACK GROWTH IN METALLIC MATERIALS 15934-MS

V. Vitek, University of Pennsylvania, Graduate School, *203 Logan Hall, Philadelphia, Pennsylvania* 19104 (DA0G8907; DAAG29-78-C-0040)

To study the development of diffusion-controlled creep crack growth which would be applicable to a wide range of metallic materials. Relevance - the research may be relevant to the evolution of improved crack growth-resistant alloys to operate in engines in high-temperature creep ranges.

Since creep crack growth is often intergranular and occurs in the temperature range where diffusive mechanisms may be active, grain boundary diffusion of atoms away from the crack tip is to be taken into account. The theory would also consider the existence of the plastic zone at the crack tip, and the nucleation and growth of cavities and microcracks ahead of the crack.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0010, ANALYSIS OF HOT TENSILE TEST DATA FOR IN-718

R.G. Thompson, Clemson University, School of Engineering, Dept. of Materials Engineering, *Rhodes Research Bldg., Clemson, South Carolina* 29631 (NAS 8-33805)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

3.0011, APPLIED QUANTUM CHEMISTRY OF NON-METALLIC MATERIALS

J.R. Van Wazer, Vanderbilt University, School of Arts & Sciences, Dept. of Science, *21st Ave. S., Nashville, Tennessee* 37232 (DF046680; AFOSR-77-3145)

AF function - Air Force flight operations have continuing needs for improved structural and environment-resistant materials. Deficiency - a need exists for methods to predict the best approaches for making new materials. Objective - the research deals with the development and practical application of the theory of materials to problems of importance to the Air Force. How work contributes - the work will provide a basis for the synthesis of desirable new materials without having to depend entrirely on trial and error experimental procedures.

The NOCOR procedure for carrying out ab initio LCAO-Mo-SCF calculations of atomic and molecular valence electronic structure will be applied to several new kinds of problems and also further improved in precision. The application of this method to the study of bonding and other properties, particularly in molecular systems containing heavy elements, will be continued and expanded. The accuracy and range of application of valence-electron methods in general will be studied and compared with other techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0012, INFRARED AND FAR-INFRARED INTERFEROMETER STUDIES OF MOLECULES OF ASTRONOMICAL INTEREST

H.W. Wilson, Western Washington University, School of Arts & Sciences, Dept. of Chemistry, *516 High St., Bellingham, Washington* 98225 (NCA 2-862101)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AN IMPROVED TURBULENCE MODELING FOR GAS TURBINE COMBUSTORS

H.C. Mongia, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (NAG 3-167)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0002, MIXED FLOW COMPRESSOR

D. Culy, Signal Co. Inc., Airesearch Manufacturing Company, *402 S. 36th St., Phoenix, Arizona* 85034 (DF459910; F33615-79-C-2028)

Design, development and demonstration of a single stage mixed flow compressor that exhibits performance equivalent to todays state-of-the-art multi-stage axial compressor at substantially lower cost.

The program includes mechanical design and development in parallel with aerodynamic design of a single stage mixed flow compressor. Complete mapping of the compressor under simulated engine test conditions would follow the fabrication phase.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0003, EXPERIMENTAL STUDY OF THE CHARACTERISTIC PROPERTIES OF VARIOUS TURBULENT SHEAR FLOWS ENCOUNTERED IN SYSTEMS OF NAVAL INTEREST

A. Roshko, California Inst. of Technology, Graduate School, Dept. of Engineering & Applied Science, *1201 E. California Blvd., Pasadena, California* 91109 (DN623976; N00014-76-C-0260)

Since the flows over all naval ships and airplanes are largely turbulent, investigations which lead to a better understanding of such flows could result in significant improvements in the performance of naval craft. This experimental task will obtain data to develop phenomenological laws to predict the effects of density differences and pressure gradient on the turbulent processes so that reliable engineering estimates are available for design.

Investigations will continue on the properties of large coherent structures in turbulent shear flows, in particular, to study the possibilities and results of interfering with and controlling them in mixing layers and separated flows. Initial specific experiments will include the following: (1) controlled perturbation of organized structure in a chemically reacting mixing layer; and (2) controlled perturbation of large structures in separated flows.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0004, EXTERNAL THERMAL PROTECTION COATING SYSTEMS

L. Meyer, California State University & Colleges, San Jose State University, Graduate School, *Washington Sq., San Jose, California* 95192 (NAG 2-99)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0005, RAPID APPROACH FOR MISSLE SYNTHESIS - RAMS

R. Bithell, General Dynamics Corp., *P.O. Box 1950, San Diego, California* 92112 (DF133140; F33615-78-C-3007)

It is often necessary to synthesize a large number of missile designs that meet different performance requirements so that mission effectiveness and design trade-off studies can be performed. To conduct these effectiveness and trade-off studies a rapid method or procedure is needed to synthesize various missile designs. This conceptual design procedure will allow one to select the most promising missile design for further exploratory development.

Develop a method to estimate the size, weight, range, maneuverability, accuracy, and cost for a conceptual air-launched supersonic missile design. Using theoretical and empirical methods a procedure will be developed so that a missile design can be synthesized. By iterating the design through the established procedure a converged conceptual design will be obtained that meets desired performance specifications. From the converged conceptual missile design the various desired quantities can then be estimated. The procedure developed will be modularized and shall be such that a digital computer can be used to perform the calculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0006, FLOW SYSTEM ON A SKID

U. Brenjestad, Northrop Corp., *3901 W. Broadway, Hawthorne, California* 90250 (DF190670; F29601-76-C-0129)

The objective is to obtain a self-contained supersonic flow system on a skid.

Northrop Corporation, in their research program, has built an identical system to that needed. Northrop will build and deliver to AFWL an identical flow system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0007, NONLINEAR ELECTROMAGNETIC SCATTERING TECHNIQUES FOR THE DETECTION AND CHARACTERIZATION OF CLOSED CRACKS

A.J. Bahr, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF053920; F49620-79-C-0005)

AF function - metal aircraft structures and turbine engine components are subject to failure by the growth of small cracks and defects introduced by fatigue and other deformation processes. Deficiency -fatigue commences immediately upon the fabrication and use of the metal article and there are inadequate nondestructive evaluation (NDE) techniques available to reject that component when catastrophic failure is imminent. Objective - the objective of this research is to develop an NDE technique capable of detecting small closed cracks on metal surfaces. How work contributes - detecting small cracks will allow parts to be rejected before catastrophic failure occurs.

Nonlinear interactions of microwave energy incident upon metal surfaces will be studied. The magnitude, source and mechanism of such interactions will be correlated with physical (strength-related) parameters of the metal surface. Closed surface cracks will be introduced, characterized and related to the nonlinear interactions in order to assess the utility of this technique for NDE applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, LATITUDINAL VARIATIONS OF AURORAL ZONE IONIZATION DISTRIBUTIONS

J. Vickrey, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF057060; F49620-80-C-0014)

AF function - many weapons systems are ionospheric-dependent such as the surveillance (OTH/B), HF Communications, and space-based navigation systems (GPS). The design and operation of future such systems will be even more dependent upon our ability to specify and forecast the state of the ionosphere on a variety of various time and distance scales. The auroral zone presents particularly difficult problems due to the large energies deposited there and sharp discontinuities which result. Opportunity - the Chatanika incoherent scatter radar is situated on the southern edge of the auroral oval and is capable of measuring energy deposition due to particle precipitation and joules heating, the ionization profile and its spatial variability, and the neutral and plasma dynamics. The ionosphere may be surveyed over a geomagnetic latitude range of 62 to 68 degrees in the E region and 56 to 73 degrees in the F region every 12 minutes with a spatial resolution of 10 km. Objective - to analyze several data sets of nearly 24-hour lengths when constant elevation measurements were made to quantitatively characterize the following: particle precipitation, energy deposition and enhanced electron densities, ionospheric electric fields, and ionization transport and heating. How work contributes - OTH radar and other ionospheric-dependent weapons systems will benefit from the increased knowledge of ability to model the auroral ionosphere.

Historical constant elevation measurements from the Chatanika radar will be analyzed for a variety of geophysical parameters to determine their diurnal and short-term variability under a variety of magnetic and auroral activities. Available ancillary data (all-sky camera photographs, DMSP auroral images, magnetograms, etc.) will be used to better understand the processes. The analysis will focus upon the determination of a general morphological description of auroral phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, ELECTRONIC SURFACE STATES OF SILICON AND III-V COMPOUND SEMICONDUCTORS

W.E. Spicer, Stanford University, Stanford Electronics Lab., *Stanford, California* 94305 (DN975214; N00014-79-C-0072)

Future electronics systems for Navy and other defense applications will require the capabilities of advanced electron and electrooptic devices fabricated on silicon and compound semiconductors. Problems of reliability, fabrication, yield and cost are directly related to the fundamental problem of trying to understand and control the processes which occur at the surfaces of these materials.

Using a complementary set of surface and thin film analytical techniques, the investigator will study the fundamental interactions which occur when various metals and insulators are deposited on compound semiconductor surfaces. One major goal is to deduce the role of surface defects (e.g., atom removal) in pinning the surface fermi level and thus establishing the Schottky barrier potential. Oxygen and metal atom interactions with silicon and selected III-V compound semiconductor surfaces will be studied to determine how they change the free surface electrical properties. Column 3 versus column 5 elements adsorbed on the surfaces should have different interactions, and indicate if the defect model is valid.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, DESIGN OF OPTIMAL DIGITAL CONTROLLERS FOR LOW ALTITUDE CRUISE MISSILES USING FREQUENCY DOMAIN TECHNIQUES

R. Whitbeck, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DN875390; N00014-79-C-0657)

Future Navy vehicles and weapons will utilize digital logic to perform complex control functions demanded by their severe mission requirements. The objectives of this third-year effort are to: (a) use results of first two years' efforts in developing modern Weiner-Hopf optimal control design techniques to synergistically (airframe-plus-control system) determine the potential benefits of unorthodox missile configurations such as the joined wing; (b) show how the terrain-following capabilities of cruise-closer missiles can be improved via optimal design of their control systems, i.e., cruise closer to the waves than otherwise would be possible to decrease probability of enemy detection.

The approach is to: (a) produce an emulation of the analog baseline design; (b) perform a direct digital design using zero-order hold and then a slewer as a coupler; (c) generate both an optimal coupler and an optimal control law using Wiener-Hopf techniques; and (d) repeat digital designs using a forward-looking radar altimeter signal.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0011, THE DESIGN METHODOLOGY OF DISTRIBUTED PROCESSING SYSTEMS

C.V. Ramamoorthy, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical Engineering & Computer Sciences, *Berkeley, California* 94720 (DF055960; F49620-79-C-0173)

AF function - data processing for avionics. Deficiency - software engineering tools for distributed data processing are inadequate for efficient exploitation of inexpensive hardware. Objective - develop software engineering tools for distributed processing systems. How work contributes - successful completion of this research will establish basis of design theory for distributed computer systems.

The research will develop design methodology to establish a basis for design theory for the development of distributed processing systems. The design methodology will provide guidelines and design laws for the systematic design and construction of distributed processing systems such that the users' requirements are satisfied. The philosophy behind the approach is multi-functional, multi-level modeling of a distributed processing system. The research will develop models and techniques for the formal specification, decomposition, testing and validation of a distributed system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, LANDSAT INVENTORY OF IRRIGATED LANDS AND SMALL GRAINS

J.E. Estes, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geography, *Santa Barbara, California* 93106 (NCC 2-124)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0013, VISUAL PROSTHETIC DEVICES USING TEXTURE ANALYSIS

T.J. Healy, University of Santa Clara, School of Engineering, Dept. of Electrical Engineering & Computer Sci/Applied Math, *Santa Clara, California* 95053 (NCC 2-128)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0014, DETERMINATION OF GLOBAL H2 DISTRIBUTION FROM THE PIONEER VENUS ORBITER ION MASS SPECTROMETER MEASUREMENTS

S. Kumar, University of Southern California, Graduate School, *3551 University Ave., Los Angeles, California* 90007 (NAG 2-95)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0015, ELECTROMAGNETIC SCATTERING PROCESSES AT RESONANCE AND WITH INTENSE FIELDS

R.W. Hellwarth, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF054890; AFOSR-79-0098)

AF function - there is a critical need to find means to eliminate deleterious effects of phase distortion of laser beams being considered for weaponry, reconnaissance and other vital AF functions. Opportunity - nonlinear phase conjugation techniques offer means to automatically correct phase distortion of optical beams caused by the atmosphere, imperfect optics or other phenomena. These techniques must be better understood, their limits explored and novel implementations considered before they can be applied to important AF problems. Objective - study nonlinear phase conjugation by brillouin scattering including reduction of threshold using near-resonant phenomena, effects of linear loss and geometric effects. Contribution - this work will supply understanding necessary to apply stimulated brillouin scattering phase conjugation techniques to prevent distortion in AF optical systems.

The approach is mainly theoretical but will include some experimental verification. The effect of linear loss, especially in waveguides, on the stimulated brillouin backscattered efficiency will be formulated and calculated. Ultimate limits imposed by such processes will be studied. Resonance enhancement of phase conjugation by stimulated Raman or brillouin scattering will be theoretically studied and experiments using dye lasers to excite dyes in waveguides will be used to verify theory. Short pulse (transient) effects will be explored. Possibilities of using polarization effects for nonlinear spectroscopy, especially at low frequencies determined by the difference in input optical frequencies, will be explored.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, RETURN-DIFFERENCE FEEDBACK DESIGN FOR ROBUST UNCERTAINTY (TOLERANCE IN STOCHASTIC MULTIVARIABLE CONTROL SYSTEMS)

M.J. Safonov, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF056610; AFOSR-80-0013)

AF function - design of aircraft control systems. Deficiency -unpredictable response variation can adversely affect system performance. Objective - the objective of this proposal is to explore new ideas in the areas of robust control systems. How work contributes -success here would provide the AF with methods that enable engineers to efficiently and systematically design the system gains.

The proposed research will be in three parts. The first part will concern the derivation and proof of the precise mathematical relationships between attainable precision of control and the return-difference quantities. The second part of the research effort will be aimed at the development of systematic methods for synthesizing feedback control systems. The third part involves the consideration of aircraft control design examples. To validate the results, and to demonstrate their usefulness in aero-

space control problems, the results will be applied to the design of an aircraft automatic pilot.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0017, COMPOUND SEMICONDUCTOR SURFACES AND INTERFACES

C.W. Wilmsen, Colorado State University, School of Engineering, Dept. of Electrical Engineering, *Fort Collins, Colorado* 80523 (DN675148; N00014-76-C-0387)

To investigate those surface properties of compound semiconductors which have application to devices for improved performance of naval electronic systems.

Growth kinetics and physical factors controlling the formantion of oxide/compound semiconductor interfaces will be studied. Auger electron spectroscopy, ESCA, and capacitance-voltage measurements will be used as primary diagnostic tools. The physical progression of interface formation will be studied by growth of thin oxide layers in steps, followed by Auger and ESCA profiling. The correlation between interface chemistry and surface states density will be studied, as well as the properties of double layer insulators.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0018, NAVY VEHICLE DESIGN AND CONSTRUCTION - TRANSONIC SHOCK-INDUCED BOUNDARY LAYER SEPARATION

J.E. Carter, United Technologies Corp., Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DN075457; N00014-80-C-0424)

Flow separation induced by the presence of strong transonic shock waves on aircraft wings results in severe degradation of the aircraft performance. For severe combat maneuvering conditions at transonic speeds, strong shocks and flow separation are probably inevitable. However, it is important for the aircraft designer to be able to predict when and where shock-induced separation occurs and whether or not the boundary layer will reattach. Only then can the adverse effects on aircraft performance be minimized. It is the objective of this research to develop a method to predict the effects of strong viscous/inviscid interactions for transonic shock-induced separated flow on bodies and wings.

The approach to be used in this research is based on a finite difference iterative solution of the compressible, turbulent boundary layer equations, expressed in inverse formulation, coupled to a finite volume solution to the inviscid transonic full potential equations. Detailed solutions of this strong viscous interaction flow will be obtained and comparisons made with experimental data in order to assess the method.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0019, HIGH REYNOLDS NUMBER VISCOUS CASCADE ANALYSIS

M.J. Werle, United Technologies Corp., Research Center, *400 Main St., East Hartford, Connecticut* 06108 (DN890251; N00019-80-C-0051)

Under the proposed program the major effort would be devoted to coupling the interacting boundary layer trailing edge solution developed under a previous contract (N00019-78-C-0604) to boundary layer and wake solutions and subsequently to a potential flow subsonic cascade solution to demonstrate a solution procedure for high Reynolds number, viscous, subsonic cascade flow. In this effort viscous flow solutions would be obtained for unstaggered cascades of symmetric airfoils. In addition, the local viscous solver for subsonic trailing edge flows would be further evaluated and refinements to the numerical solution procedure involving asymptotic far-field representations, improved differencing procedures, grid stretching, etc., would be applied as indicated.

Analytical study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0020, SOLAR FLARES AND COMMUNICATIONS

R.F. Howard, Carnegie Institution of Washington, *1530 P St. N.W., Washington, District of Columbia* 20005 (DN723093; N00014-76-C-0113)

Naval communications, navigation, and surveillance systems are degraded or completely disrupted by ionospheric and magnetospheric disturbances caused by solar flare activity. The primary goal of this program is to develop an adequate understanding of solar flares to allow prediction of flare activity and the resulting geomagnetic disturbances. Research is performed on the physical mechanisms responsible for solar activity, solar flares, and the solar cycle.

Full disk magnetograms, spectroheliograms, and photoheliograms are taken at the Mt. Wilson Observatory and are analyzed to study the formation of action regions, development of flares, and differential rotation and its relation to solar activity. The data are provided in near-real-time to NOAA and the Air Force Global Weather Central when they are major factors in predicting solar activity and geomagnetic storms.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0021, NONSTEADY FLOW INDUCTION

J.V. Foa, George Washington University, Graduate School of Arts & Sciences, *901 23rd St. N.W., Washington, District of Columbia* 20037 (DF057880; F49620-80-C-0043)

AF function - advanced aerospace vehicles. Deficiency -insufficient fundamental knowledge about flow induction processes involving the work of interface pressure forces. Objective - advance the state of knowledge for flow induction mechanisms involving a direct transfer of mechanical energy from driving to driven flow. In particular, the investigation is focused on flows in which the desired energy transfer is effected by interface pressure forces at moving interfaces. How work contributes - the thrust augmenting ejector is one of the most promising devices for use in potential powered lift applications. Nonsteady flow ejectors are of particular interest because, in theory, the least dissipative way of transferring energy from a primary to a secondary flow is through the action of pressure forces at a moving fluid interface. Even in steady flow ejectors, the migration of finite-size eddies from one flow into the other gives use to eddy-surface pressure forces which do work. Better understanding of these processes could lead to ejectors of significantly improved performance.

The combined theoretical and experimental investigation will center on three topics. The stability of primary-secondary flow interfaces will be studied by means of diagnostic probing of the interaction flow field using hot wire anemometry and means of an analysis of a rotating cascade of pseudoblades including the effect of Coriolis forces and the effect of the curl associated with the rotation of the rotor (original FOA ejector) on the mixing rate. An analytical study will be made of the effect of turbulent eddy scale on the relative magnitude of momentum transfer by pressure and viscous forces and of ways to control eddy scale for given merger conditions. Finally, an experimental study will be made of the feasibility of generating pseudoblades by means of rotating stall through cascades of high solidity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0022, EVALUATION AND DEVELOPMENT OF CONSTITUTIVE RELATIONS FOR INELASTIC BEHAVIOR

J. Eftis, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (DF058260; AFOSR-80-0096)

AF function - aerospace vehicles. Deficiency - present methods available for analytic and computational description of structural material behavior, particularly under severe operating conditions of vital interest, are seriously inadequate and significantly impact aerospace vehicle frame and engine performance, durability and cost. Objective - to be able to accurately, quickly and economically describe the structural behavior of materials. How work contributes - provides, as the first stages in an integrated research program, for a careful and thorough review,

synthesis and critical assessment of the current state of technology in the field of solid material constitutive theory development, with an eye toward identifying both existing gaps in knowledge and those areas which provide the greatest potential Air Force-relevant payoff.

A study will be made of the nonlinear maximum entropy method of spectral analysis. In particular, the method will be implemented on a small computer. For this purpose, the existing algorithm will be modified to meet the constraints of smaller memory capacity and shorter word length. The algorithm will be developed to improve its convergence. Optimal choice of algorithm parameters and the extension of the method to more than two channels of data will be considered. Applications will be made to real data, such as data from seismic and geomagnetic detectors.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, GRADUATE STUDENT RESEARCHERS PROGRAM

B.G. Silverman, George Washington University, School of Engineering & Applied Sciences, Dept. of Engineering Administration, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NGT 09-010-800)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of External Relations

4.0024, ENGINEERING DESIGN AND FABRICATION OF A PROTOTYPE STATE-OF-THE-ART SPACE SUIT

L.H. Olson, Georgia Inst. of Technology, School of Engineering, Dept. of Textile Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NCC 2-119)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0025, EFFECTS OF AMBIENTS ON MICROELECTRONIC COMPONENTS

M.G. Kovac, Georgia Technology Research Inst., *Atlanta, Georgia* 30332 (DF912490; F30602-78-C-0120)

To establish maximum allowable moisture content for specific military microcircuits.

The investigator will vary the moisture content of 8080 microprocessors to determine both parametric and catastrophic failure thresholds due to moisture. The effects of cracked glass and contaminants will be studied in order to identify the surface- or material-related failure mechanisms. Research will then concentrate on the establishment of the moisture threshold for the specific device under test.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0026, MODULATION DOPED GaAs/AlGaAs LAYERED STRUCTURES

M. Morkoc, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (DF057460; AFOSR-80-0084)

Low-temperature FET operation has been limited to cooling GaAs FETs which have been designed for room temperature operation in an attempt to achieve better performance. The results have been only slight improvements in noise figure and gain because lowering the temperature of a FET designed for room temperature operation only substantially reduces phenon scattering. The impurity scattering remains and becomes dominant as the temperature is lowered. In order to take full advantage of the lower temperatures, the doping levels must also be reduced while special precautions are taken so that conditons of velocity saturation are maintained. Objective - design and investigate micron and submicron GaAs devices specifically designed for cryogenically cooled applications to microwave FETs and high-speed topic modulation-doped GaAs/AlGaAs layered structures.

Develop the appropriate molecular beam epitaxy-growth procedures, investigate conventional GaAs FETs with and without GaAs and AlGaAs buffer layers, obtain detailed electrical and optical characterization of MBE layers - ion implant source and drain - and determine temperature dependence of electron mobility for the epitaxial layer grown by MBE.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, EXCITON COLLECTION FROM ANTENNA SYSTEMS INTO ACCESSIBLE TRAPS

L.R. Faulkner, University of Illinois, Urbana Champaign Campus, Materials Research Lab., *Urbana, Illinois* 61801 (004404 TICNO; CH-1198-021)

Interfacial photochemistry can be driven by light absorbed elsewhere and transmitted by exciton propagation to the interfacial region. This project concerns the conditions for propagation and collection of energy at interfaces in thin film systems. The materials of concern are molecular solids, including crystalline aromatic species, and dispersions of aromatics in polymers, such as polystyrene. Exciton traps are typically submonolayer surface coverages of a polycyclic hydrocarbon on a thicker film (1000 to 5000 A) containing the antenna chromophore. Propagation and collection of excitons is being explored by steady-state and time-resolved fluorescence spectroscopy. Other work involves the development of methods for creating thin film assemblies of molecular materials via vacuum processing techniques and methods for the microstructural characterization of such systems.

BIBLIOGRAPHIC REFERENCES: Faulkner, L.R., et al., Interfacial Photoprocesses in Molecular Thin Film Systems, in ACS Advances in Chemistry Series Volume 184, M.S. Wrighton (ed.), American Chemical Society, Washington, DC, 1979.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

4.0028, STUDIES OF IONOSPHERIC DYNAMICS BY INCOHERENT SCATTER

S.A. Bowhill, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *106 Engineering Hall, Urbana, Illinois* 61801 (ATM78-15224)

This grant supports research in atmospheric dynamics using an incoherent scatter radar technique. Specifically to be studied are: mesospheric dynamics, morphology and dynamics of a 150 km altitude over the geomagnetic equator; and sporadic E behavior.

The mesospheric studies will include horizontal wind measurements and a harmonic analysis of vertical velocity oscillations to seek gravity wave spectral density fluctuations versus height and season as well as vertical coherence distances. Results will be compared with anticipated influencing factors (e.g., vertical shear of horizontal wind).

A recurring echo seen overhead at the Jicammarca Observatory, near an altitude of 150 km, has been noted but not investigated to date. This research will analyze such echoes to seek to identify the type of irregularity involved, and thereby identify which plasma dynamical effects come to the fore in the equatorial E region.

A vertical shear in horizontal winds of the neutral atmosphere near 100 km is believed to produce thin layers of strongly enhanced ionization in the lower thermosphere - the wind shear theory of sporadic E layers. This research will extend study of this phenomenon by employing observations from the Arecibo Observatory in a theoretical study of the relationships between intense sporadic E layers and tangentially discontinuous flow in the neutral atmosphere (nonlinear gravity wave theory would be employed).

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

4.0029, DETERMINATION OF EJECTION SEAT/MAN AERODYNAMIC PARAMETERS

D.C. Chiang, Rose Hulman Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *5500 Wabash Ave., Terre Haute, Indiana* 47803 (DF058220; AFOSR-80-0147)

AF function - advanced aerospace vehicles. Deficiency - inadequate methods are available for predicting the aerodynamic parameters for ejection seat/man configurations. Objective - to carry-out the adaptation of the Mark IV computer code for supersonic-hypersonic flow past arbitrary bodies to the case of ejection seat/man configurations. How work contributes - will provide an engineering level analysis tool which will help overcome the deficiency noted.

Pressure probes and hot wire anemometry will be used to obtain data on low-speed flow past an axisymmetric body (hemispherical nose with hemispheroidal rear section) at angle of attack. Mean and fluctuating velocity measurements will be taken in the attached boundary layer, while a five-hole Pitot probe will be employed in the thick boundary layer region near vortex formation. A special three-hole yaw probe resting on the surface will be used to determine the direction of the wall shear stress. An alternating direction, implicit three-dimensional computational procedure for boundary layer flows will be extended to cases in which large and reversing cross-flows occur, as well as to cases in which the boundary layer degenerates into a vortical flow.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0030, MARK X/XII MODELING STUDY

A. Fitch, U.S. Dept. of Defense, Electromagnetic Compatibility Analysis Center, *Annapolis, Maryland* 21402 (DF904500; F19628-78-C-0006)

Transfer of funds to ECAC/ACL, Annapolis, MD, 21402, for continuation of work begun in FY77 for a probabilistic description of a set of sensors for AF purposes - the Air Traffic Control Radar Beacon (ATCRBS) in conjunction with the military Mark SIF system and military cryptosecure Mark XII system. This is the third incremental funding.

The system parameters to be considered are interrogator power, PRF, mode interface, side-lobe suppression and antenna characteristics, transponder receiver sensitivity and output power. Sensitivity of performance to variations in each system parameter will be evaluated. Sensitivity of AIMS performance to operating conditions will also be evaluated. Estimates of AIMS performance obtained for hypothesized European tactical scenarios will be the bases of the algorithm.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0031, NAVIGATION - STELLAR HORIZON ATMOSPHERIC DISPERSION POSITIONING SYSTEM

D.G. Currie, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DN075600; N00014-79-C-0931)

The object of this work unit is to develop and evaluate the two-color refractometer for use in a stellar horizon atmospheric dispersion (SHAD) navigation system which determines its position from the amount of atmospheric refraction produced on light coming from horizon stars and thereby determines the location of the observation platform relative to the planet Earth.

The contractor will develop and evaluate the two-color refractometer for use in a stellar horizon atmospheric dispersion (SHAD) navigational system. Various aspects of the performance of the two-color refractometer will be determined both from telescope measurements and laboratory measurements. Final fabrication of a partially completed two-color refractometer will be accomplished. Ground-based measurements will be conducted with this instrument to determine the accuracy and precision of the two-color refractometer. A new detector will be developed to increase data rate and provide correction of possible errors. Radiation effects on the sensor will be investigated. The electronics packaging and the fine-pointing optical system will be upgraded.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0032, UNSTEADY TURBULENT BOUNDARY LAYER WIND TUNNEL EXPERIMENTS

E. Covert, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF053960; F49620-79-C-0226)

AF function - aerospace vehicles, propulsion and power. Opportunity - gain further understanding of the structure of turbulence and other time-dependent aspects of boundary layers. Objective - develop dynamical models of the unsteady turbulent boundary layer phenomenon. How work contributes - statistical theories have not been able to adequately explain turbulent transport of heat, mass or momentum (drag). Observations indicate that there is an ordered structure underlying turbulence that cannot be shown in time-averaged statistical approaches. The wave theories of secondary breakdown developed by Professor Landahl and the time-dependent disturbance to be characterized by Professor Covert should serve as the cornerstones of a new dynamical theory of turbulence. If successful, the new theory should aid in drag reduction and dynamic stall reduction techniques.

The unsteady local flow around a well-documented airfoil (NACA 0012) will be obtained in a steady flow field using a rotating elliptical cylinder near the airfoil trailing edge. Unsteady pressure measurements, unsteady local skin friction, tangential velocity components and other boundary layer parameter measurements will be taken and analyzed with respect to the phase angles of the unsteady velocities relative to that of the excitation. The airfoil will be held stationary at all times. Plane Poiseuille flow experiments of transitional spots will be taken to study their spanwise spreading, streamwise propagation, velocity field and streak formation with different initial disturbances and with polymer additives. Theoretical analysis methods will be developed for localized three-dimensional boundary layer disturbances for linear and nonlinear cases.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0033, DEVELOPMENT OF LASER-OPERATED PHYTOPLANKTON PROFILING SYSTEM

G. Evans, Woods Hole Oceanographic Institution, *Main St., Woods Hole; Massachusetts* 02543 (NAS 6-3160)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0034, HEAT TRANSFER AND FLOW CHARACTERISTICS IN NAVAL THERMAL CYCLES

E.R. Eckert, University of Minnesota, Minneapolis Campus, School of Engineering, Dept. of Mechanical Engineering, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DN823027; N00014-76-C-0246)

The objective of this research is to understand and be able to predict accurately localized heat transfer and flow characteristics of working fluids in thermal systems, particularly heat exchangers and gas turbines, for the propulsion of naval ships and aircraft. This capability is particularly important in achieving higher temperatures and therefore increased thermal efficiencies and specific powers, with reliability, in naval propulsion systems.

Theoretical and analytical techniques are sought, based upon experimental data, to understand local heat transfer and flow characteristics in gas turbines and heat exchangers. Experimental techniques utilized include laser Doppler anemometry and napthaline sublimation for the measurement of flow velocities and heat transfer rates.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0035, II-IV-V2 CHALCOPYRITES FOR HIGH-SPEED DEVICES

C.M. Wolfe, Washington University, School of Engineering & Applied Science, Dept. of Electrical Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (DF054860; AFOSR-79-0096)

AF function - microwave solid-state electronic devices are essential components of Air Force reconnaissance, electronic

countermeasures and communications systems. Opportunity Air Force systems' needs continue to demand improvements in frequency, power, bandwidth, noise performance and efficiency in solid-state electronic devices. Currently GaAs, InP, and III-V ternary and quaternary alloys of various compositions are being investigated because of their high electron mobility, high saturated velocity and transferred electron effects. The II-IV-V2 chalcopyrites offer similar parameters but without the disadvantages of low thermal conductivity and other effects caused by random alloy scattering. Objective - to develop suitable growth techniques for ZnGeAs2 on GaAs or Ge, CdSnP2 on InP, and determine the suitability of these materials for application in high-speed devices. How work contributes - successful completion of this effort could lead to new or improved types of microwave device materials.

Epitaxial layers of CdSnP2 will be grown on InP substrates in a liquid-phase epitaxial system using elemental Cd and P as initial sources in a Sn solution. Variations in melt temperature, melt composition, and cool-down rate will be accomplished to obtain good quality epilayers. Epitaxial layers of ZnGeAs2 will be grown on GaAs or Ge substrates in a vapor phase system using elemental Zn and Ge, and AsCl3 as a source of As and Cl to transport the Ge. Variations in source and substrate temperatures and flow rates will be made to obtain good quality epilayers. Investigation of intentionally added dopants will be performed in both types of materials. Other technologies, including that for forming ohmic contacts and Schottky barriers, and the development of etchants for the delineation of interfaces and defects, will also need to be developed so that the resulting layers can be characterized.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0036, SURFACE PASSIVATION OF III-IV COMPOUND SEMICONDUCTORS FOR MICROWAVE APPLICATIONS

J.A. Woollam, University of Nebraska, Lincoln Campus, School of Engineering & Technology, Dept. of Electrical Engineering, *Lincoln, Nebraska* 68508 (NAG 3-154)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0037, EVALUATION OF DIFFERENTIAL ABSORPTION LIDAR

R.J. Byer, U.S. Environmental Protection Agency, *Research Triangle Park, North Carolina* 27709 (DF336430)

To evaluate the capability of differential absorption lidar for remote (non-contact) sensing of environmental pollutants generated by Air Force operations. Presently available point-monitoring sensors have proven unreliable/inappropriate for determining the contribution of airfield operations to local environmental quality. A DIAL system would provide an integrated pollutant map.

An existing differential absorption lidar (DIAL) system will be used on targets of opportunity to determine the suitability of DIAL measurements for mapping concentrations of pollutants, including hydrocarbons and sulfur dioxide. Joint funding with EPA.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0038, GAS CORRELATION FOR CARBON MONOXIDE

L.W. Chaney, U.S. Environmental Protection Agency, *Research Triangle Park, North Carolina* 27709 (DF336440)

To evaluate the capability of gas correlation spectroscopy for the remote (non-contact) sensing of carbon monoxide. Presently available point-monitoring sensors have proven unreliable or inappropriate for determining the contribution of airfield operations to local environmental quality. A remote system would provide an integrated pollutant load.

Joint funding with EPA. Two existing systems will be evaluated by an independent party to determine their sensitivity, specificity, accuracy and reliability, and to recommend improvements.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

4.0039, OPTICAL WAVEGUIDE SPATIAL FILTERS

D.W. Vahey, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF054470; F49620-79-C-0044)

AF function - advanced Air Force weapons systems require the real-time processing of data obtained from a multitude of sensors at data rates which exceed current capabilities. This requirement necessitates the development of analog parallel processing techniques such as optical or acoustooptical processing. Opportunity - an integrated optical format must be found before such processing can be realizable on-board aircraft and missiles. Objective - this research will investigate programmable spatial filters integrated into an optical waveguide. Such filters would be suitable for performing real-time correlations on binary signals. How work contributes - the effort advances optical processors for command and control sytems, especially for signal acquisition.

In an effort to eventually demonstrate programmable spatial filtering, a portion of the effort will be expended toward perfecting fixed grating filters by increasing the diffraction efficiency and by increasing the number of bits. This will be accomplished by using arsenic tri-sulfide rather than photoresist for the grating material. Studies will continue in an effort to conceive better waveguide filter designs. A programmable filter utilizing an electrooptic Bragg grating will be designed, fabricated, and demonstrated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0040, COMPUTERIZED MATHEMATICAL MODEL FOR OPTIMIZING COST AND ELECTRIC OUTPUT OF PHOSPHORIC ACID FUEL CELLS

K.A. Alkasab, Cleveland State University, Fenn College of Engineering, Dept. of Mechanical Engineering, *1983 E. 24th, Cleveland, Ohio* 44115 (NCC 3-17)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0041, AN INVESTIGATION OF THE ELECTRICAL CHARACTERISTICS OF A RECTENNA ELEMENT AND A RECTENNA ARRAY

J.E. Maisel, Cleveland State University, Fenn College of Engineering, Dept. of Electrical Engineering, *1983 E. 24th, Cleveland, Ohio* 44115 (NAG 3-169)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0042, MODELING OF TURBULENCE IN FREE SHEAR LAYERS AND MIXING ZONES

J.D. Lee, Ohio State University Research Foundation, *1314 Kinnear Rd., Columbus, Ohio* 43212 (DF058820; AFOSR-80-0216)

AF function - advanced weaponry and aerospace vehicles. Opportunity - improvement in understanding of two aspects of fluid mechanics of gas lasers. These are the diffuser-ejector region, and the turbulent mixing of supersonic streams of reactants. Objective - to gain more basic understanding of the details of turbulent mixing between co-planar supersonic streams of dissimilar gases, and to gain a more basic understanding of the flow field in a short, multi-channel diffuser with mixing from local multiple ejectors. How work contributes - this program will provide information useful in the design of high-power gas flow lasers.

Co-planar and cylindrical multi-channel supersonic nozzle arrays will be used to supply simulated laser cavities, both cold and heated, which will be processed through diffuser systems with and without local ejector nozzles. The latter will be used both for boost-pumping and for local boundary layer control. An arc-heated wind tunnel fitted with two co-planar supersonic nozzles with separately controlled supply plenums will be used

for the mixing study. Rotational temperature turbulence in the mixing region will be monitored on a time-resolved basis by means of electron beam spectroscopy. Sources of turbulence in the flow field will be identified and their importance defined. An attempt will be made to identify large-scale coherent structures in the mixing layers. Theoretical modeling of two-stream mixing flow and of ejector pumping flow will be extended.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0043, FLIGHT LOADS SIMULATION CAPABILITY

F.K. Bogner, University of Dayton, School of Engineering, Dept. of Mechanical Engineering, *300 College Park Ave., Dayton, Ohio* 45469 (DF138400; F33615-76-C-3135)

There is currently no facility in existence in the free world in which flight loads on an aircraft structure can be realistically simulated during a ballistic impact on the structure. Also, it is presently very difficult, if not impossible, to determine residual strengths of large sections of aircraft structures after they have been damaged by ballistic impact. The objective of this effort is to design and fabricate a loading system which will have the dual capability listed above. Development of such a facility will result in greatly improved simulation during survivability/vulnerability tests on USAF aircraft.

A contractor will be selected through a multiple-source procurement to perform this effort. The contractor will design and build the loading system which will be installed in the AFFDL vertical gun range. In addition, the contractor will supply test specimens which will be tested in the facility to evaluate its performance. The contractor will also develop an analysis capability as a part of this effort which can be used to predict stresses and probable points of failure in ballistically damaged aircraft structures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0044, TURBULENT FLOW IN CRYOGENIC FACE SEALS

W.F. Hughes, Carnegie Mellon University, Carnegie Inst. of Technology, Dept. of Mechanical Engineering, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (NAG 3-166)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0045, ANALYTICAL INVESTIGATION OF HIGH PERFORMANCE SHORT EJECTOR THRUST EJECTOR AUGMENTATION

T. Yang, Clemson University, School of Engineering, Dept. of Mechanical Engineering, *Rhodes Research Bldg., Clemson, South Carolina* 29631 (DN078816; N00167-80-C-0040)

To theoretically establish thrust augmentaion ratio for new contoured short ejector with l/d ratio ranging from 2.5 to 5.0 and to evaluate the trade-off between the cost of using an auxiliary ejector as a boundary layer control device and the thrust gains. This contract is in support of DTNSRDC work unit 1606-300, reported under DN678328.

The short diffuser inverse design code of the Clemson Univ. will be employed to derive new ejector diffuser contours. The concept of using auxiliary ejectors as boundary layer control devices is introduced and will be evaluated for effectiveness and trade-offs. The Clemson code will then be coupled with the DTNSRDC ejector flow computer program for optimizing the mixing section of the new ejector. Ejector optimization may be carried out either by man-in-loop action or coupling a numerical optimization technique. The boundary layer suction by auxiliary ejectors will be specified first and then updated interactively with flow entrainment required by auxiliary ejectors. A final report will be submitted three months after completion of the project.

SUPPORTED BY U.S. Dept. of Defense, Navy, David W. Taylor Naval Ship Research & Development Center

4.0046, TRANSIENT AIRFLOW MEASUREMENT

S. Webofer, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF420953; F40600-77-C-0003)

The objective of this effort is to develop a method to measure engine transient airflow and to calibrate an Air Force Aero-Propulsion Laboratory (AFAPL) engine inlet bellmouth system for use in transient airflow testsing of a J85 engine.

An experimental test facility will be fabricated using a critical flow venturi in series with a throttling plug assembly (TPA). The TPA will consist of a shrouded bullet-nose and strut assembly and a translating variable area plug. The TPA will be calibrated for airflow rates as a function of plug position.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0047, INVESTIGATION OF FOUNTAIN JET STRUCTURE

W. Foley, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF056590; F49620-80-C-0003)

AF function - advanced aerospace vehicles. Deficiency - difficulty exists in predicting the forces and moments induced on powered lift vehicles due to exhaust jet interactions during landing and takeoff. Objective - to determine the mechanisms controlling the observed behavior of fountain jets. How work contributes - to design successful powered lift aircraft, it is essential to be able to predict jet-induced forces and moments. Basic information will be acquired which is necessary in devising prediction methods for the flow field effects of fountain jets.

An experimental study will be made of fully three-dimensional fountain jets. Measurements will be taken of turbulence intensities and spreading and decay rates. A determination will be made of the correlation between ground jet turbulence and fountain jet turbulence. The influence on fountain jet spreading rate of disturbance in the stagnation region of the ground jets will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0048, EFFECTS OF WARHEAD-INDUCED DAMAGE ON THE AEROELASTIC CHARACTERISTICS OF LIFTING SURFACES

R.O. Stearman, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering, *200 W. 21st, Austin, Texas* 78712 (DF051760; AFOSR-78-3569)

AF function - this research contributes to R.O. 4.2 (Aerodynamics), R.O. 4.4 (aeromechanical elements) and R.O. 6.2 (conventional munitions). Deficiency - the ability to predict the onset of failure and highly divergent flutter instabilities caused by damaged lifting surfaces is nonexistent. The chief difficulty lies in the aerodynamic modeling and description of the problem, as there exists no aerodynamic theory to treat lifting surfaces with damages in the form of surface discontinuity. Objective - to develop methodology for the aeroelastic analysis of damaged fighter aircrafts. To relate the effects of damaged lifting surfaces to changes in aeroelastic characteristics. Contribution - this research will acquire the ability to analytically predict the aerodynamic loading on and the response of damaged lifting surfaces in flow regimes of interest.

Analytical studies will first be carried out to demonstrate that several types of critical damage to aircraft will promote destructive aeroelastic instabilities. An investigation of the different available techniques for identifying the proper unsteady aerodynamic modelling of damaged lifting surfaces will then be accomplished by a combined analytical/experimental effort. This would include a study on recently developed system identification techniques as well as extensive wind tunnel testing on damanged lifting surfaces to provide insight into the development of analytical flow models useful in aeroelastic analyses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0049, RADIATION PRODUCTION BY CHARGED PARTICLE BEAMS EJECTED FROM A PLASMA FOCUS
G.M. Molen, Old Dominion University, School of Engineering, Dept. of Electrical Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (DF055950; F49620-79-C-0151)

AF function - the AF must be able to assure that its systems are hardened to withstand certain radiation levels from nuclear weapons. Deficiency - no laboratory radiation source can produce high enough intensities to simulate nuclear weapons effects over system size volumes. Objective - this research program is aimed at understanding a new X-ray source which the PI has developed. This new X-ray source is based upon a focused electron beam produced by a plasma focus device. Dr. Molen intends to measure the characteristics of both the electron beam and the X-rays it produces. Contribution - this research program will contribute to the development of laboratory radiation sources to simulate nuclear weapons effects.

The Mark IV plasma focus system will be transferred from the Aerospace Corporation to the Electrical Engineering Department at Old Dominion University and will be assembled and made operational. The system will be configured so as to produce a focused electron beam directed into the anode. Extensive diagnostics will be made on the ejected electron beam current that is transported through the drift tube. A high frequency Faraday cup will be modified to measure contributions to the electron current from lower energy electrons. Qualitative estimates of the electron energy of the beam will be made by the use of various thicknesses of dielectric films for which the forward electron range is known. The temporal current profile measured with the Faraday cup will be compared with X-ray emission from the converter region as well as the softer bremsstrahlung radiation produced at the plasma pinch.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0050, MEASUREMENT OF UNSTEADY PRESSURES ON COMPRESSOR BLADES
W.F. O'Brien, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Mechanical Engineering, *Blacksburg, Virginia* 24061 (NAG 1-156)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0051, VISUALIZATION STUDY OF TURBULENT SPOTS
J.J. Riley, Flow Industries Inc., *21414 68th Ave. S., Kent, Washington* 98031 (DF052140; F49620-78-C-0062)

AF function - aerospace vehicles. Opportunity - provide a better understanding of the coherent structures in a turbulent boundary layer and the events leading to transition to turbulence. Objective - visually observe a flat-plate boundary layer with turbulence and turbulent spots imbedded within to provide information and understanding of the physical processes of transition to turbulence and maintenance of turbulence. How work contributes - the AF is interested in boundary layer control to reduce or control the effects of drag and flow separation. As yet, what triggers transition to turbulence, how best to maintain laminar flow or prevent separation of the structure of a turbulent boundary layer are not known or fully understood. This research will provide visual insight into these problems to aid the design of future aerospace vehicles.

Flow visualization techniques of fluorescent dye lasers, dye injections and shadowgraph of flow over a flat plate in a tow tank will be used to study the structure of turbulent spots and their interactions in a laminar boundary layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0052, CRYOGENIC ENERGY STORAGE FOR SPACE APPLICATIONS
R.W. Boom, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Nuclear Engineering/Metallurgical & Mineral Engin, *Madison, Wisconsin* 53706 (NAG 3-170)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0053, APPLICATION OF FUNCTIONAL ANALYSIS IN FLUID MECHANICS
L. Napolitano, Universita degli Studi di Napoli, *1 Corso Umberto, Naples, Italy* (DF054480; AFOSR-79-0055)

AF function - advanced aerospace vehicles. Opportunity - to provide improved design and analysis computational tools suitable for the development and evaluation of future, high performance Air Force aerospace vehicles. Objective - to develop a new class of spline functions applicable to interpolation and/or smoothing problems for closed curves (one-dimensional spline) or closed surfaces (two-dimensional spline). How work contributes - in computational aerodynamics it is often necessary to solve interpolating problems for closed curves. Using classical splines for such cases is, in general, unsatisfactory due to problems arising at the closure point. This work has potential application in computational fluid dynamics to geometry specification and grid handling for complex geometric shapes representative of realistic flight vehicles.

The research will apply functional analysis in order to define and study various classes of closed-spline functions. This will involve the definition of the spline functions as solutions of appropriate minimization problems in Hilbert spaces. A number of optimization and trade off problems associated with applications of the splines will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, MATRIX PHASES OF CARBONACEOUS CHONDRITES
P.R. Buseck, Arizona State University, School of Liberal Arts, Dept. of Chemistry/Geology, *Tempe, Arizona* 85281 (NAGW 143)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0002, ENVIRONMENTAL SAMPLING FOR MONITORING DESERTIFICATION INDICATORS
C.F. Hutchinson, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (NAS13-172)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0003, SOLAR DIAMETER MEASUREMENTS FOR STUDY OF SUN CLIMATE COUPLING
H.A. Hill, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (NAG 5-143)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0004, THUNDERSTORM RESEARCH USING KSC-USAF ELECTRIC FIELD MEASURING SYSTEM AND ITS OPERATIONAL UTILIZATION AT KSC
E.P. Krider, University of Arizona, School of Liberal Arts, Dept. of Atmospheric Sciences, *Tucson, Arizona* 85721 (NAS10-10082)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

5.0005, PHYSICAL AND CHEMICAL PROPERTIES OF THE OUTER MICRON OF PLANETARY MATERIALS
T.A. Tombrello, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (NAGW 148)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0006, PROPOSAL TO INVESTIGATE THE CLOUDS AND ATMOSPHERE OF VENUS
A.T. Young, California State University & Colleges, San Diego State University, School of Sciences, Dept. of Astronomy, *5402 College Ave., San Diego, California* 92115 (NAG 2-92)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0007, PULSED BLUE/GREEN PROPAGATION IN FOG
M. Geller, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Communications Systems & Technology Dept., *San Diego, California* 92152 (DN087528)

To study the spatial and temporal dispersion of a blue/green pulse after propagating through maritime fogs.

The following measurements through fog between two experimental field sites on Point Loma will be made: (1) a determination of the fog density which is the integrated value of the extinction coefficient along the propagation path, Tau, and 2) the propagation path loss as a function of the field of view of the detector for values of Tau between 0 and 35. To minimize the effect of the temporal variation of the fog, the data for each run must be obtained and recorded in a time less than 3 seconds. This will be accomplished by continuously monitoring and recording Tau, by a direct beam, non-scattered, fixed field of view (FOV) photomultiplier. The mechanical changes to vary the FOV of the 2 variable FOV detectors are motorized and automated. A computer will be used to control, process and record the data from these detectors. The values of Tau and the time histories of the pulses from eight different FOV settings (four from each variable FOV receiver) will be digitized and stored in a floppy disk.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

5.0008, THERMAL ISOSTASY IN THE WORLD'S OCEANS
G. Schubert, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Earth & Space Sciences, *405 Hilgard Ave., Los Angeles, California* 90024 (NAG 5-152)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0009, LANDSAT DISPLAY DEVELOPMENT
R.L. Danielson, University of Santa Clara, School of Engineering, Dept. of Electrical Engineering & Computer Science, *Santa Clara, California* 95053 (NCA 2-685101)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0010, RESEARCH RELATIVE TO SHORT-TERM CRYOSPHERE CLOUD INTERACTIONS NEAR THE SNOW/ICE LIMIT
R.G. Barry, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Geography, *1200 University Ave., Boulder, Colorado* 80302 (NAG 5-142)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0011, THE EFFECT OF MOUNTAINS OF SURFACE DRAG AND LOCAL METEOROLOGY
R.B. Smith, Yale University, Graduate School, Dept. of Geology & Geophysics, *206 Elm, New Haven, Connecticut* 06520 (ATM77-22175)

This research project will investigate the mechanisms of mountain drag using a combined approach: (a) a mathematical investigation of flow over large amplitude topography, (b) laboratory experiments to determine how mountain drag might vary with wind speed, static stability, mountain height, etc., and to investigate the way in which mountain waves break down to cause turbulence aloft, and (c) field measurements of the pressure drag acting on different mountains under different synoptic conditions to gain an appreciation of the importance and variability of mountain drag, and surface measurements of wind and temperature to help determine the drag mechanisms and the influence of the mountain on local meteorology.

The results of this research may aid in the forecasting of synoptic scale weather through better parameterization of surface drag, and in the improved prediction of clear air turbulence, severe downslope winds and flow stagnation associated with frost damage and air pollution episodes in mountainous areas.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0012, HEAT CAPACITY MAPPING MISSION (HCMM) DATA INVESTIGATION - USE OF THERMAL INERTIA DETERMINED BY HCMM TO PREDICT NOCTURNAL COLD-PRONE AREAS IN FL
L.H. Allen, State University System of Florida, University of Florida, Inst. of Food & Agricultural Sciences, *Gainesville, Florida* 32611 (NAS 5-26453)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0013, SOMALI CURRENT FIELD WORK, 1979
W. Duing, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., *4600 Rickenbacker Cswy., Coral Gables, Florida* 33149 (ATM78-18174)

This research program involves a continuing effort at collecting a series of hydrographic measurements and current profiles of the Somali Current. The Somali Current is a rapidly moving boundary current in the western Arabian Sea off the northeast coast of Africa. This ocean current is intimately connected with the Southwest Monsoon winds that provide moisture and energy from the Indian Ocean and Arabian Sea for the summer monsoon rains. Measurements will be made during three cruises aboard the Universtiy of Miami's R/V Iselin; before the onset of the Southwest Monsoon, during its onset and at the peak of the monsoon. These measurements are part of an organized international program called the Monsoon Experiment (MONEX), a regional subprogram of the Global Atmospheric Research Program (GARP), and will occur between February and July, 1979. The measurements by the PI will be supplemented by measurements from moored instruments and by a remote sensing program monitoring sea surface temperatures. Among the most important objectives of this research are: (1) to determine the spatial and temporal scales of large-scale eddies and related upwelling zones; and (2) to investigate the horizontal and vertical extent of the Somali Current and the recently discovered deep counterflow beneath it. These features will provide a picture of the time-dependent evolution of this oceanic boundary current in response to the atmospheric monsoon. This program, in conjunction with the other MONEX observations, is a one-time chance at getting simultaneous measurements of monsoon forcing and ocean response.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0014, REGOLITH ADSORPTION AND EXCHANGE OF ATMOSPHERIC CONSTITUENTS ON MARS
F. Fanale, University of Hawaii System, Manoa Campus, Graduate School, *Spalding Hall, Room 359, Honolulu, Hawaii* 96822 (NAGW 171)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0015, AERIAL MEASURING SYSTEM (AMS)
J.F. Doyle, E G & G Inc., *Idaho Falls, Idaho* (100102 TICNO; 600001)

The AMS operation provides both an airborne radiological monitoring system capability for emergency response to a nuclear accident and an aerial remote sensing and ground correlation

program. The 24-hour-a-day nuclear emergency capability is operational out of both a western and eastern base, using two fixed-wing survey aircraft continuously and partial annual use of helicopters. The aerial remote sensing/ground correlation provides data on: (1) naturally occurring radiation in the environment; (2) radiation contamination whose type and amount are influenced by man-made activities; and (3) measurements of geological, hydrological, and ecological features. The Aerial Measurement System (AMS) Program is divided into two segments. The operation's activity includes the actual carrying out of the aerial monitoring mission. The technical support segment provides the technical and scientific back-up, including instrumentation and data analysis.

SUPPORTED BY U.S. Dept. of Energy, Office of Environmental Compliance & Overview

5.0016, EQUIPMENT TO UPGRADE A SCANNING ELECTRON MICROSCOPE

L. Grossman, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (EAR78-23420)

Edward Anders, Robert N. Clayton, Lawrence Grossman, Edward Olsen and Joseph V. Smith share in the operation costs and uses of a scanning electron microscope and attached X-ray analyzer housed in the Department of the Geophysical Sciences at the University of Chicago. Each investigator employs this instrument in the course of his research on meteorites. This is a request for funds to obtain equipment necessary to derive quantitative chemical analyses from this system, including a dedicated, on-line mini-computer, a back-scattered electron detector and a beam current monitor. Each investigator requires this capability in his own research in order to analyze phases smaller than can be resolved optically in the electron microprobe. Edward Anders wishes to identify the host phases of isotopically anomalous noble gases in carbonaceous chondrites. Robert N. Clayton wishes to use this technique to aid in the interpretation of the results of ion microprobe and cathodoluminescence studies of Allende inclusions. Lawrence Grossman will employ this capability to identify submicroscopic primary and secondary condensate phases in Allende inclusions. Edward Olsen will apply this technique in his studies of the micro-mineralogy of Type 2 carbonaceous chondrites. Joseph V. Smith will use the instrument to study the histories of differentiated meteorites, as recorded by their mineralogy.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0017, AN ATLAS OF PALEOGEOGRAPHIC MAPS

A.M. Ziegler, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (EAR79-15133)

This action provides continuing support for the completion and publication of a series of paleogeographic reconstructions for thirty time intervals ranging from the Late Precambrian to the Recent. The maps will show continental orientations, reconstructed biogeography, climatology, tectonic regime and the economic deposits for each time interval. The location of the continents is based on paleomagnetic measurements and checked by reference to available biogeographic data and plate tectonic considerations. The atlas is a summary and synthesis of present understanding of plate tectonics during Phanerozoic time and will provide a forum for reinterpreting the wealth of data in the geologic literature and will help focus future research.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0018, STUDIES OF THE ROLE OF METASTABLES AND DOUBLY IONIZED SPECIES IN THE CHEMICAL AND THERMAL STRUCTURE OF THE VENUSIAN AND MARTIAN IONOSPHERES

J.L. Fox, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (NAG 2-94)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0019, INVESTIGATION OF SURFACE WAVE AND TURBULENCE PHENONEMA

Unknown, Johns Hopkins University, Graduate School, *34th & Charles Sts., Baltimore, Maryland* 21218 (NAS 6-3162)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0020, REMOTE SENSING OF VEGETATION OF SOIL MOISTURE

J.A. Kong, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 5-141)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0021, DETERMINATION OF GENERAL CIRCULATION OF THE OCEAN AND MARINE GEOID USING SATELLITE ALTIMETRY

C.I. Wunsch, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology & Physical Oceanography, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 6-9)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0022, LIDAR MEASUREMENTS OF ATMOSPHERIC DENSITY

D.E. Bedo, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582840)

AF function - vehicle tracking, RV trajectory prediction, interception. Deficiency - insufficient information on a timely basis of the atmospheric density and variations in density at altitudes below 30 kilometers as is required for advanced reentry systems. Objective - the design, development and fabrication of a satellite-borne laser radar (lidar) system capable of providing near real-time remote density measurements at stratospheric altitudes and below. How research contributes - the satellite lidar system will probe the lower atmosphere and provide near real-time measurements of the atmospheric density at altitudes below 30 kilometers. Such data are of value to the Air Weather Service in support of strategic missile systems and in the development of low altitude density and weather prediction techniques.

The lidar system to be developed will be based on the detection of Rayleigh scattered laser light using a satellite-based transmitter and receiver. The hardened laser will be operated in a pulsed mode with power and repetition frequency determined by mission requirements and specific spacecraft capabilities. The lidar design will be compatible with an altitude resolution of one kilometer and absolute accuracy of better than 15 percent in the determination of density. Gating and timing circuitry will restrict the observations to altitudes below 30 kilometers. In addition to density determinations, the scattered signal will provide information on aerosol distributions within the probed regions and will allow deduction of the atmospheric transmission from the satellite to the ground.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, MULTISPECTRAL ANALYSIS FOR DMSP IMAGERY

J.T. Bunting, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584300)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of adequate information to meet military weather support requirements. Objective - to evaluate cloud estimates from near-IR, visible and IR satellite imagery and to develop algorithms for estimating mesoscale visibility parameters from satellite data. How development contributes - improves the centralized processing of new and existing satellite imagery channels and provides estimates of cloud properties presently not available from satellite data.

Data from the first DMSP special sensor 'C', a near-IR imager, will be acquired along with visible and IR imagery data and surface weather reports. Cases of water clouds, ice clouds, and snow cover will be sought so that algorithms for cloud identification proposed by in-house work unit 76701302 (snow cloud discriminator sensor design), and CWU 669802AK (cloud specification by automated multispectral imagery analysis), can be evaluated for a more general range of cloud and surface conditions than were encountered in the limited data samples for sensor development. These data will be used to develop multispectral algorithms for estimates of visibility parameters, such as the probability of a cloud free-line-of-sight in an area of 25 by 25 NMI.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, SATELLITE MEASUREMENTS OF SOLAR UV

H.E. Hinteregger, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581280)

AF function - vehicle tracking during flight and reentry, trajectory prediction, communication systems. Deficiency - insufficient data to allow accurate modelling of the average composition and structure of the upper atmosphere and of the ionosphere, and to predict the response of the atmosphere and ionosphere to temporal variations in the solar input. Objective - determine the importance of the solar radiation within the spectral range from 140 to 1850 Angstroms in maintaining the composition and thermal structure of the upper atmosphere. Develop a set of indices characterizing the temporal variation of this solar radiation, which is the putative cause of the variations in the atmospheric composition, density and thermal structure. How research contributes - measurements of this solar radiation are made eleven times a day, at various latitudes, longitudes and solar zenith angles. The measurements are continued through many solar rotations, and are to be examined in correlative studies with other observed effects. Atmospheric composition, density and temperature are measured by analysis of the attenuation profiles of selected solar emission lines during perigee passes and at sunrise and sunset.

Specially designed grazing incidence spectrometers are mounted on a solar-oriented platform on the NASA Atmosphere Explorer series satelittes. The instruments cover the spectral range from 140 to 1850 Angstroms, and each is made-up of 24 individual spectrometers, multiplexed onto 12 detectors. The satellite contains an apogee motor, so that perigee passes down to 120 km can be maintained by an occasional apogee burn. The low perigee altitude allows the study of attenuation of the solar radiation in certain emission lines, from which composition, density, and temperature of the upper atmosphere may be derived. Above the attenuation region, but below the energetic particle belts, unattenuated incident solar fluxes are measured. During sunrise and sunset at the satellite the occultation of the sun by the upper atmosphere allows analysis of the atmosphere remote from and below the satellite orbit. Three separate orbit orientations are used. The AE-C orbit has a 65 degree inclination, AE-D (failed in January, 1976) was in a polar orbit, and AE-E, overlapping the second in time, has a near-equatorial orbit. Each orbit had a nominal perigee of 150 km and initial apogee of 4000 km. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, SOLAR PARTICLE EVENT-TIME-INTENSITY PROFILE PREDICTION

D.G. Smart, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584720)

AF function - survivability, solar effects on satellite operations, detection and surveillance systems, and communications. Deficiency -inability to satisfactorily and accurately predict the solar particle events that affect the aerospace environment in which USAF systems operate. Objective - to develop techniques for predicting the time-intensity profiles of various components of solar particle events. How research contributes - significant solar particle events interfere with a number of satellite-borne surveillance and detection systems and also communication systems. The ability to predict the time-intensity profile of solar particle events enables a forecast center to predict when an event may exceed the interference threshold for a specific system, how severe the interference will be and how long the event will exceed the interference threshold.

The energetic solar particle data acquired under a previous work unit as well as significant recent solar particle event data will be used to develop models of solar particle events. The models of the events will be used as predictors of other events, and then the model predicted time-intensity profiles compared with actual data to identify major deficiencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, STRATOSPHERIC AEROSOLS

W.K. Vickery, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584480)

AF function - to provide environmental impact assessments of Air Force systems which operate in or through the stratosphere. Deficiency - the role of aerosol particulates in the removal of pollutants in the stratosphere is not well understood. Objective - to determine the size, number distribution and composition of stratospheric aerosols. How development contributes - direct in situ measurements will provide better inputs on the role of aerosol particles in the stratosphere, thus providing more accurate impact assessments.

Conduct two statospheric balloon flights in early FY80 to measure stratospheric particle size and number density. These flights are to verify previously obtained data which show significantly different data than currently accepted values. These flights are to use the current Epsilon/AFGL instrument which is being utilized in an LDF-funded effort to develop the design criteria for modification which will permit measurement of the composition of aerosol particles. Following design completion during FY79 under the LDF program, the fabrication of a flight instrument will begin during FY80. Construction is expected to be completed in early FY81. At that time, a two-year measurement program will begin to determine particulate parameters in a set of matrix measurements for various altitudes and locations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, SPECTRAL INTERFEROMETER SWIR DAYLIGHT BACKGROUND

N.B. Wheeler, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583080)

AF function - this work supports the Air Force functions of detection, surveillance, tracking and early warning. Deficiency -present operational and future satellite infrared surveillance systems at short-and middle-infrared wavelengths are limited by the background clutter from enhanced atmospheric emissions from disturbed atmospheres, both natural, such as aurora, and nuclear. Improvements in such systems will depend on proper selection of spectral filters. Objective - to obtain high resolution short- and middle-infrared spectra of atmospheric emissions associated with natural and disturbed daylight backgrounds. How research contributes - spectral properties of the daylight auroral and natural backgrounds will be measured from 1.5 to 7.5 micrometers and categorized. The results will be presented to Air Force program offices as appropriate and utilized in predictive infrared nuclear code development and in system design.

A rocket-borne field-widened interferometer has been developed. It is capable of obtaining excellent spectra at 2 cm-1 resolution. It has become feasible to make high-resolution sensitive measurements of atmospheric emitters in the natural and

disturbed daylight atmosphere. One rocket-borne instrument will be launched at White Sands, New Mexico, for undisturbed mid-latitude backgrounds. Another rocket-borne instrument will be launched at Poker Flat, Alaska, into a daylight auroral event. The spectra so obtained with these flights will be important tools in understanding the chemistry of these emitters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, LARGE-SCALE ZONAL STRUCTURE OF EQUATORIAL CURRENTS IN THE TROPICAL PACIFIC

J.R. Luyten, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (OCE79-21786)

A field program will be carried out in the Pacific Ocean to determine the zonal and temporal scales of the equatorial current system. Particular emphasis will be given to assessing the dynamical significance of the multiple jet structures in transporting heat and momentum, both vertically and zonally, in the equatorial band.

In addition, the technical development of a bottom-moored acoustic profiler, capable of obtaining time series over as long as one year, of vertical profiles of horizontal velocity and temperature over the full ocean depth, will be initiated. Such a capability will be essential for any large-scale, long-term observational program which requires velocity measurements over a significant portion of the water column, greater than five-to-six-hundred meters. The development program will be coupled closely with the observational program to insure the scientific utility of the instrument.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0029, GRAVITY, TOPOGRAPHY AND CRUSTAL EVOLUTION OF VENUS

Unknown, Woods Hole Oceanographic Institution, *Main St., Woods Hole, Massachusetts* 02543 (NAG 2-91)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0030, SIMULTANEOUS MEASUREMENTS OF HYDROGEN AND OXYGEN EXOSPHERIC TEMPERATURES

S.K. Atreya, University of Michigan, Ann Arbor Campus, Graduate School, Dept. of Atmospheric & Oceanic Science, *Rackham Bldg., Ann Arbor, Michigan* 48104 (ATM79-01064)

Two outstanding problems in our understanding of the planetary exospheres are intimately tied to a knowledge of the (line) profiles of the geocoronal hydrogen emissions: the extent to which particles in 'satellite orbits' are present; and the degree to which a non-thermal component of escaping hydrogen may be present. An accurate spectral line shape measurement of the geocoronal hydrogen emissions addresses these questions. From the Doppler line profile, one can also determine the temperature associated with the emitting region. A precise and accurate measurement of the temperature in the exosphere of the earth is important for understanding the planetary escape of light gases and for modeling the atmosphere which lies below the exobase. The escaping gases, primarily hydrogen, are expected to undergo evaporative cooling, and create an exosphere in which each species has a slightly different temperature. As a direct consequence of this cooling, the escape rate of light gases will be reduced, resulting in an increase in the thermospheric content of hydrogen (and a reduction of the altitude where the flux limit occurs). A further effect is that the measure of exospheric temperature of hydrogen is not a direct measure of the temperature of the major constituent gas.

This grant funds an attack on these problems by allowing, for the first time, simultaneous measurements of the exospheric hydrogen temperature and the thermospheric temperature of the major gas, oxygen. The program will be carried out at Arecibo, which is unique for this purpose.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0031, INCORPORATION OF LANDSAT TECHNOLOGY INTO FARMER'S INFORMATION SYSTEM BEING DEVELOPED BY NASA AND THE MISSOURI FARMER'S ASSOCIATION

R. Pirog, University of Missouri, Columbia Campus, Graduate School, *205 Jesse Hall, Columbia, Missouri* 65201 (NAS13-174)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0032, OLIVINE-MAGNA DENSITY RELATIONS AT HIGH PRESSURE - BEARING ON THE DIFFERENTIATION OF THE TERRESTRIAL PLANETS

C.T. Herzberg, Rutgers the State University of New Jersey, New Brunswick Campus, Graduate School, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (NAGW 177)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

5.0033, THE HUMAN ECOLOGY OF AGRICULTURAL PRODUCTION IN RUKWA REGION, TANZANIA (1940'S-1950'S) - DOCTORAL DISSERTATION RESEARCH

B.A. Bury, Columbia University, Graduate School of Arts & Sciences, *Broadway & W. 116th St., New York, New York* 10027 (SES80-16418)

The human ecology of agricultural production will be examined in the context of environmental crisis, and in relation to economic and political conditions in Rukwa Region, Tanzania. Models previously developed to describe the relationships between human population, resources and technology are deterministic and one-dimensional, failing to explain the complexity that these relationships actually demonstrate in the world. This research will develop a more dynamic model of the relationship between population density, environmental resources and technology by documenting and contrasting agricultural production stratagies in relation to political and economic conditions during the severe drought of the 1950s and non-drought conditions.

The methodology of this study includes the interpretation of aerial photography from 1950 and 1978, analysis of meteorological, soils and agricultural data, oral interviewing and archival research. The research has important implications for agricultural development efforts in tropical Africa in general, and Tanzania in particular, where agricultural populations have recently been reorganized into larger settlements in efforts to directly integrate development efforts.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Social & Economic Sciences

5.0034, DIGITAL IMAGE ANALYSIS EQUIPMENT

F.M. Henderson, State University of New York, Albany Campus, School of Social & Behavioral Sciences, Dept. of Geography, *1400 Washington Ave., Albany, New York* 12222 (SER80-04413)

The digital image processing equipment will be used for basic and applied remote sensing research and for the training of students in remote sensing techniques and applications. The equipment will be used for research dealing with the development of techniques for: (1) detecting and monitoring gypsy moth defoliation, (2) inventorying and monitoring forest cover, (3) the use of SEASAT synthetic aperture radar and shuttle imaging radar systems to obtain urban data, (4) satellite imaging radar systems in monitoring strip mine activities, and (5) the use

of digital LANDSAT data to obtain wildlife management information.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Social & Economic Sciences

5.0035, EFFECTS OF THE OCEANS ON POLAR MOTION
S.R. Dickman, State University of New York, Binghamton Campus, School of Arts & Sciences, Dept. of Geophysics, *Vestal Parkway, Binghamton, New York* 13901 (NAG 5-145)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0036, FINITE ELEMENT INVESTIGATION OF LITHOSPHERE TECTONICS
H.J. Melosh, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Sciences, *Stony Brook, New York* 11790 (NAG 5-151)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0037, PHOTOMETRIC OBSERVATIONS SUPPORTING SOUNDING ROCKETS 33.019 AND 33.020
E.R. Manring, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (NAS 5-26510)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0038, SYSTEMATIC GLOBAL MEASUREMENTS OF METHANE AND CARBON MONOXIDE
R.A. Rasmussen, Oregon Graduate Center, Graduate School, Dept. of Environmental Science, *19600 N.W. Walker Rd., Beaverton, Oregon* 97005 (NAG 1-160)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0039, DEVELOP AND CONDUCT REMOTE SENSING SHORT COURSES AND SEMINARS
R.O. Fullerton, State University & Community College System of Tennessee, Middle Tennessee State University, School of Liberal Arts, Dept. of Geography & Geology, *Murfreesboro, Tennessee* 37130 (NAS13-171)

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

5.0040, PRELIMINARY INVESTIGATION OF COMETARY DUST IN THE ANTARCTIC ICE
E.A. King, University of Houston, School of Arts & Sciences, Dept. of Geology, *3801 Cullen Blvd., Houston, Texas* 77004 (DPP78-20410)

The proposed research will make a preliminary investigation of fine and ultrafine particles in approximately 30 samples of microparticles from the Antarctic ice cores in an attempt to identify populations of particles that are derived from comets. Cosmic particles will be identified by composition, mineralogy and morphology as appropriate. An attempt will be made to identify populations of particles that have originated from the non-volatile portions of comets by correlations of cosmic particle populations with the times of dusty comet minimum and maximum activity.

If there is success in identifying populations of particles that are likely to have originated from comets, it will be possible to provide some constraints on the origin of comets and on the evolution of the Solar System. It may be that the particles that come from comets are similar to certain carbonaceous chondrites. If this is so, it would add considerable credibility to this point of view and to models of Solar System formation and history of which this is a necessary part. On the other hand, if we find that cometary particles are in some way different from known types of carbonaceous chondrites, this would be a result of even greater interest.

The investigation of cosmic dust from the Antarctic ice offers for the first time the real possibility of the identification of the solid materials from comets.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0041, HEAT CAPACITY MAPPING MISSION (HCMM) DATA - CONTINUING SCHEMATIC DESIGN AND SCIENTIFIC APPLICATIONS AND FDT SUPPORT
W.E. Miller, Brigham Young University, School of Physical & Mathematical Sciences, Dept. of Geology, *B-166 A S B, Provo, Utah* 84601 (NAS 5-26473)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0042, GLOBAL SCALE DIAGNOSIS OF SATELLITE DATA
J. Paegle, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (NAG 5-127)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0043, CLOUD POPULATIONS AND THEIR INTERACTION WITH THE BOUNDARY LAYER
M. Garstang, University of Virginia, School of Arts & Sciences, Dept. of Environmental Science, *Garrett Hall, Charlottesville, Virginia* 22903 (ATM74-21701)

This project continues to deal with the analysis of specific parts of the GARP Atlantic Tropical Experiment (GATE) data and provides essential components of the overall objectives of the experiment. Two areas are selected for analysis: (a) the subcloud and lower cloud layer; (b) the cloud layer. In each, the objective is first to establish structure and second to examine interaction. Structure and interaction are examined in terms of scales of convective organization, with both the analysis and the interpretation being unified by the development of a common classification scheme. The proposed work is further conceived upon the principle that the analysis program will be closely coordinated with many other national and international groups. Subcloud and lower cloud layer observations obtained aboard the B-scale ships and cloud photography from ships and aircraft form the basic input. Products of the research are carefully designed to provide a foundation for a substantial part of the GATE analysis program with particular emphasis on interaction with numerical modeling.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0044, AIR-SEA INTERACTION STUDIES FOR SATELLITE MEASUREMENTS
R.A. Brown, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (NAG 1-149)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0045, MEASUREMENT OF OH RADICALS IN THE LOWER ATMOSPHERE BY THE 14C TRACER METHOD
J.C. Sheppard, Washington State University, School of Engineering, Dept. of Engineering Science, *Pullman, Washington* 99163 (NAG 2-97)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0046, THE COLLECTION AND ANALYSIS OF ANTARCTIC AUTOMATIC WEATHER STATION DATA
C.R. Stearns, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DPP79-25040)

In this study, four automatic weather stations (AWS) will be installed in the Antarctic Peninsula area during the austral summer of 1981/82 for a three-year study of barrier winds, foehn storm winds, terrain effects and ice transport from the Weddell Sea. These units will be shipped via the British Ship BRANSFIELD in late 1980 to the British station at Rothera for deployment the following austral summer using the British twin otter aircraft. The data from these AWS units will be transmitted back to northern hemisphere readout stations via polar orbiting Tiros N and NOAA-6 satellites.

In addition to the above effort, responsibility will be assumed for the maintenance and repair of the other AWS units now in operation in the vicinity of McMurdo, Dome C, and Byrd, Antarctica. The data received from all AWS units will be processed into scientific units and made availabe to other researchers needing these data, and modifications to the AWS units to increase their reliability, accuracy, versatility, and lifetime will be explored.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0047, CONTINUED TECHNICAL SUPPORT TO THE FIRST GARP GLOBAL EXPERIMENT (FGGE) SPECIAL EFFORT PROGRAM
V.E. Suomi, University of Wisconsin, Madison Campus, School of Natural Resources, Dept. of Meteorology, *Agriculture Hall, Madison, Wisconsin* 53706 (NAS 5-26450)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0048, DEVELOPMENT OF A CENTRALIZED STORM INFORMATION SYSTEM AT THE NATIONAL SEVERE STORMS CENTER FEED UNITS
V.E. Suomi, University of Wisconsin, Madison Campus, School of Natural Sciences, Dept. of Meteorology, *Agriculture Hall, Madison, Wisconsin* 53706 (NASW 3476)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0049, ON SEVERE STORM PHENOMENOLOGY AND ENERGETICS FROM SATELLITE IMAGERY
D.N. Sikdar, University of Wisconsin, Milwaukee Campus, School of Letters & Science, Dept. of Geological Sciences, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (ATM77-24842)

The objective of this research is to use satellite data from the Geostationary satellite and the conventional meteorological data to study thunderstorm evolutionary features more quantitatively than would be possible from conventional soundings alone.

The satellite data will be analyzed to reveal cloud motions as a measure of winds, cloud amount, and heights. The cloud growth and decay will be observed by the application of high resolution imagery obtained at short intervals (three to six minutes).

The occurrence of precipitation will be determined by correlation between cloud formation and growth, and rainfall occurrences at the underlying surface.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, STUDY OF CELLULAR IMMUNE RESPONSE
B.S. Criswell, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (NAS 9-16268)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0002, STABILITY AND SENSITIVITY ANALYSIS OF LIFE SUPPORT SYSTEMS
G.N. Stephanopoulos, California Inst. of Technology, Graduate School, Dept. of Chemistry & Chemical Engineering, *1201 E. California Blvd., Pasadena, California* 91109 (NCC 2-122)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0003, ASSESSMENT OF AIRLINE PILOTS RHYTHM SYNCHRONY
D.C. Holley, California State University & Colleges, San Jose State University, School of Science, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NCC 2-116)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, THE EFFECTS OF SIMULATED WEIGHTLESSNESS ON REGIONAL BLOOD FLOW SPECIFICALLY DURING CARDIOVASCULAR STRESS
D.C. Harrison, Stanford University, School of Medicine, Dept. of Medicine, *300 Pasteur Dr., Stanford, California* 94305 (NCC 2-126)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, RESEARCH EXPEDITION TO STUDY PROCHLORAN IN PALAU
R.A. Lewin, University of California, San Diego Campus, Scripps Institution of Oceanography, Marine Biology Research Division, *P.O. Box 1529, La Jolla, California* 92038 (NAGW 181)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0006, RESEARCH ON SIMULATOR TRAINING EFFECTIVENESS
P.W. Caro, Seville Research Corp., *Pensacola, Florida* 32505 (DF049310; F49620-77-C-0112)

AF function - this research supports aircrew training, mission readiness, the development of critical combat skills, and the USAF Flight Simulator Procurement Program. Deficiency - modern flight simulators are complex physical systems that simulate other complex physical systems such as aircraft. Because of this emphasis on physical systems, the personnel who design flight simulators are almost exclusively engineers. As a result, flight training simulators usually reflect physical rather than behavioral models. Once the simulator is built and installed in the field, an operational test and evaluation (OT&E) is conducted to determine if the simulator is an effective training device. However, the relationship between training effectiveness and combat readiness is not always clear. This seems to be caused by the lack of an adequate definition of combat readiness which is meaningful in the OT&E/aircrew training context. Objective - this research will determine the relationship between physical models and training effectiveness and recommend ways to translate behavioral models into a form which is understandable by design engineers. A new conceptual methodology for OT&E's will be developed which defines combat readiness in terms which are related to training effectiveness in measurable ways. How research contributes - more effective simulator design and operational testing of that design will occur as a result of the conceptual developments of this research.

The simulator design process will be studied and techniques of using training information to impact the design will be assessed. Ways of communicating instructional considerations to the designer will be studied. Current concepts of operational combat readiness will be articulated through literature search

and interviews with appropriate officials. The existing OT&E process will be examined and a new way of stating combat readiness in testable training parameters will be developed. A case study of an ongoing simulator OT&E will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0007, RESEARCH AND DEVELOPMENT OF A MICROWAVE INACTIVATOR POWER SOURCE (DA0K7589)
F.L. Cain, Georgia Technology Research Inst., *Atlanta, Georgia* 30332 (DA0G0024; DAMD17 79 C 9066)

The technical objective is to develop a microwave inactivator power source following specifications outlined in RFQ DAMD17-78-Q-8413. There is a military requirement for this equipment which will be used in WRAIR research studies of enzymatic activity and neurochemical levels in the central nervous system.

Research areas to be utilized are (a) high voltage technology, (b) pulse and digital technology, (c) mechanical technology, and (d) control system technology.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Walter Reed Army Inst. of Research

6.0008, DETECTION AND ESTIMATION OF SINGLE EVENT-RELATED POTENTIALS
C.D. McGillem, Purdue University, School of Electrical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (DF055280; F49620-79-C-0084)

AF function - work load measures which incorporate reliable/valid electrophysiological techniques will be extremely useful for assessing and predicting human operator performance and requirements in the design and operation of advanced and more complex Air Force systems. Deficiency - little research has been reported that relates directly to the characterization of the transient waveform associated with a single event-related potential. Objective - the proposed research will develop and apply techniques for investigating the characteristics of the single event-related potential. How research contributes - techniques aimed directly at the single evoked brain potential have only recently advanced and require further development and specific characterization in Air Force mission-related contexts for consideration as part of an on-line work load measurement technology which incorporates the best available measures of physiological and neuropsychological processes.

The research will be accomplished through the techniques capable of providing quantitative estimates of parameters associated with individual responses and components of individual response as opposed to the averaging techniques widely employed at the present time.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, RESPONSE OF THE CARDIOVASCULAR SYSTEM TO VIBRATION AND COMBINED STRESSES
C.F. Knapp, University of Kentucky, School of Engineering, Dept. of Mechanical Engineering, *Limestone & Euclid, Lexington, Kentucky* 40506 (DF053900; AFOSR-80-0039)

AF function - environmental stresses such as acceleration and/or vibration compromise aircrew performance. Circulation may be extended to critical limits since it is directly affected by these forces and is indirectly involved in all adjustments of the body to environmental stress. Deficiency - with the development and deployment of high performance terrain-following tactical aircraft, operational crews are exposed to high g-onset rates and to time-dependent acceleration loadings below 1.0 Hz. There is a lack of information available concerning responses at frequencies below 1.0 Hz. The design of effective countermeasures to acceleration stress depends upon the understanding of the mechanisms responsible for cardiovascular regulation. Because of the invasive nature of the instrumentation required for assessing cardiovascular responses, studies will be performed using chronically instrumented canines. Objective - the proposed studies are designed to 1) yield needed quantitative information about the cardiovascular system's ability to function in, and adjust to, ultra-low-frequency acceleration environments, 2) allow a qualitative evaluation of the possible hazards of exposure to such acceleration stress, and 3) to provide a means of analyzing the frequency reponse of the cardiac and vascular control mechanisms, acting to maintain circulatory integrity, during exposure to these dynamic, total-circulatory (i.e., whole body) acceleration loadings.

Emphasis will be placed on 1) the quantification of the frequency response characteristics of cardiovascular regulation, using Fourier analysis, with a shifting of focus toward specific receptors, i.e., carotid sinus pressure, venous volume and the vestibular apparatus with specific peripheral vascular effectors acting; 2) the identification of the source of the increase in mean arterial pressure associated with oscillatory acceleration loading, a pressure increase which appears to be independent of autonomic effector activity; and 3) a detailed study of the frequency response characteristics of participating myocardial mechanisms, with the addition of ultrasonic dimension instrumentation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0010, LOCALIZATION AND HISTOCHEMICAL AND PHYSIOLOGIC CHARACTERISTICS OF THE CENTRAL EMETIC APPARATUS RELATED TO MOTION SICKNESS
K.R. Brizzee, Tulane University of Louisiana, School of Medicine, Dept. of Anatomy/Pharmacology, *1430 Tulane Ave., New Orleans, Louisiana* 70112 (NAG 2-101)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0011, GONADAL STEROIDS AND MUSCLE ATROPHY
S.R. Max, University of Maryland, Baltimore Professional Schools, School of Medicine, Dept. of Neurology, *655 W. Baltimore St., Baltimore, Maryland* 21201 (NAG 2-100)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0012, HABITUATION OF NOVEL VISUAL VESTIBULAR ENVIRONMENTS WITH PARTICULAR REFERENCE TO SPACE FLIGHT
L.R. Young, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 2-88)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0013, STRUCTURES OF MEMORY FOR CRITICAL FLIGHT INFORMATION
R.W. Schvaneveldt, New Mexico State University, Las Cruces Campus, School of Arts & Sciences, Dept. of Psychology, *University Park, Las Cruces, New Mexico* 88003 (DF224490; F33615-80-C-0004)

To investigate how critical flight information is stored in pilot's memory. To determine if a common associative structure exists in the memory of pilots having varying experience and ability levels. That is, do pilots employ a common system for classifying and remembering critical flight information.

Pilots will be tested on sentence classification tasks. Subject matter will be relevant to aircraft systems, system functions, and pilot procedures. The structure of pilot memory will be inferred from the time delay required for pilots to place sentences containing aircraft-related terms into previously defined categories. If memory structure is sequentially ordered, then items occurring late in the sequence will require more time for sentence classification than items occurring earlier in the memory sequence.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0014, EXTENDED INVESTIGATION INTO PILOT AND SYSTEM RESPONSE TO CRITICAL IN-FLIGHT EVENTS
T.H. Rockwell, Ohio State University, Columbus Campus, School of Engineering, Dept. of Industrial & Systems Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 2-75)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0015, EFFECT OF CEREBROSPINAL FLUID, HORMONAL AND IONIC COMPOSITION ON SALT/WATER METABOLISM
W.B. Severs, Pennsylvania State University, Milton S. Hershey Medical Center, School of Medicine, Dept. of Pharmacology, *500 University Dr., Hershey, Pennsylvania* 17033 (NCC 2-127)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0016, REGULATION OF ERYTHROPOIESIS IN MICE DURING SPACE FLIGHT
Unknown, Baylor University, Graduate School, *5th & Speight, Waco, Texas* 76703 (NAS 2-10801)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0017, AUTONOMIC MECHANISMS IN MAN
D.L. Eckberg, Virginia Commonwealth University, Medical College of Virginia, Dept. of Medicine, *1200 E. Broad St., Richmond, Virginia* 23298 (NAG 9-14)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, MULTIVARIABLE PROBLEMS OF STATISTICS AND INFORMATION THEORY
J.N. Srivastava, Colorado State University, School of Natural Sciences, Dept. of Statistics, *Fort Collins, Colorado* 80523 (DF046270; AFOSR-77-3127)

AF function - command, control and communications - information retrieval systems - improve the methods of data collection and analysis. Deficiency - good and efficient statistical methods still need to be developed for collecting and analyzing data related to the different factors influencing the function of command, control and communications systems, hierarchical information retrieval schemes, and pattern recognition and optimal design theory. Objective - develop good basic results to help improve coding methods and information retrieval systems, reduce costs and save time in the collection of large amounts of data without any damage to the statistical quality of the data being collected; improve the methods of clustering and pattern recognition. How work contributes - improve the methods used in investigations using experimental units that are scarce and/or costly, improve the efficiency of coding schemes, help model the construction of hierarchical information retrieval schemes, and improve the existing results in clustering used, for example, in pattern recognition.

Research will continue in several areas which include (1) optimal design theory, particularly on balanced factorial designs with three levels for each of the factors; (2) work on a class of search procedures which are connected with the so-called ridge regression techniques; (3) work will continue in the area of two-dimensional block designs; (4) search and inference techniques in the theory of search linear models; (5) multivariate analysis of variance and cluster analysis; (6) linear codes; (7) characterization of designs; and (8) information retrieval systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, AN INVESTIGATION OF SHAPE-PRESERVING CURVE AND SURFACE APPROXIMATION WITH APPLICATIONS
J.A. Roulier, University of Connecticut, Storrs Campus, Graduate School, *Storrs, Connecticut* 06268 (NAG 1-153)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0003, NOSS COMPUTER PERFORMANCE STUDIES
R.D. Shelton, University of Louisville, Speed Scientific School, Dept. of Applied Mathematics & Computer Science, *Belknap Campus, Louisville, Kentucky* 40208 (NAS 5-26504)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0004, DEVELOPMENTS OF PRESSURE MODULATOR RADIOMETER MONOMERS AND POLYMERS (IMPROVING PERFORMANCE OF PRESSURE MODULATOR RADIOMETER SYSTEMS)
W.M. Ritchey, Case Western Reserve University, School of Engineering, Dept. of Macromolecular Science/Chemistry, *University Cir., Cleveland, Ohio* 44106 (NAG 3-163)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

7.0005, DYNAMIC COLOR GRAPHICS FOR INTERACTIVE SIMULATION AND DATA ANALYSIS
T.S. Heines, Cleveland State University, James J. Nance College of Business Admin., Dept. of Computer & Information Science, *Cleveland, Ohio* 44115 (NAG 3-162)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

7.0006, INTERACTIVE INITIALIZATION OF HEAT FLUX PARAMETERS FOR NUMERICAL MODELS USING SATELLITE TEMPERATURE
Unknown, Pennsylvania State University, University Park Campus, Graduate School, *205 Kern Graduate Bldg., University Park, Pennsylvania* 16802 (NAS 5-26456)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0007, THEORY OF DECENTRALIZED CONTROL OF MARKOVIAN DECISION MODELS
A. Greenland, George Mason University, School of Arts & Sciences, Dept. of Mathematical Sciences, *400 University Dr., Fairfax, Virginia* 22030 (NAG 5-148)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, STUDY OF THE INTERACTION OF THE JOVIAN MAGNETOSPHERE WITH THE RINGS AND THE GALILEAN SATELLITES
C.P. Sonett, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (NAGW 157)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0002, MEASUREMENT OF JOVIAN WINDS FROM VOYAGER IMAGES
A.P. Ingersoll, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Sciences, *1201 E. California Blvd., Pasadena, California* 91109 (NAGW 159)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0003, A COMPARATIVE STUDY OF JOVIAN AND TERRESTRIAL
R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (NAGW 164)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0004, COMPUTER SIMULATION OF SURFACE AND FILM PROCESSES
W.A. Tiller, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (NCC 2-125)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0005, NEW THEORETICAL MODELS OF JUPITER'S IONOSPHERE IN RESPONSE TO THE RESULTS OF RADIO OCCULTATION OBSERVATIONS
V.R. Eshleman, Stanford University, School of Humanities & Sciences, Dept. of Astronomy, *Stanford, California* 94305 (NAGW 152)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0006, INVESTIGATION OF THE PROPERTIES OF DOPED SILCON-ON-SAPPHIRE FOR FAR INFRARED BOLOMETERS
T.H. Geballe, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (NCC 2-120)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0007, LASER ANNEALING OF SILICON-ON-SAPPHIRE (SOS) FILMS
R.N. Reedy, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Electronics Engineering & Sciences Dept., *San Diego, California* 92152 (DN988538)

The technical objective of the program is to generate thin (0.2-0.3 micrometer) silicon-on-sapphire (SOS) films with carrier mobilities currently available only in much thicker films (0.5 micrometer); these thin SOS films will be utilized for fabrication of high performance MOS circuitry.

The approach will be to utilize laser annealing and ion implantation to improve the quality of SOS films. The major thrust will be to create a buried amorphous layer by means of channelized ion implantation and then to use laser annealing to recrystallize the silicon from the surface by means of solid-state epitaxial regrowth. The upper surface would then be stripped back, yielding a high quality thin SOS film. Variations of the application of laser annealing will be investigated further, and pursued as appropriate. MOS test devices will be designed, fabricated and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0008, SUPERCONDUCTING RECEIVERS FOR NEAR-MILLIMETER WAVELENGTHS
P.L. Richards, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (NAG 2-102)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0009, STUDIES OF THE JOVIAN MAGNETOPAUSE AND BOUNDARY LAYER
M.G. Kivelson, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Earth & Space Sciences, *405 Hilgard Ave., Los Angeles, California* 90024 (NAGW 162)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0010, JOVIAN DISK AND AURORAL OBSERVATIONS - CONTINUING ANALYSIS PLAN
L.A. Broadfoot, University of Southern California, Graduate School, *3551 University Ave., Los Angeles, California* 90007 (NAGW 161)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0011, A PROPOSED STUDY OF THE TEMPORAL MORPHOLOGY OF THE IO PLASMA UTILIZING THE PIONEER AND VOYAGER EXTREME ULTRAVIOLET DATA
R. Wu, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (NAGW 163)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0012, A PROGRAM TO STUDY HIGH ALTITUDE CLOUD DISTRIBUTIONS FOR THE JUPITER DATA ANALYSIS PROGRAM
C.W. Hord, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAGW 155)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0013, ANALYSIS OF VOYAGER IMAGING METHANE BAND PHOTOMETRY
R.E. West, University of Colorado, Boulder Campus, School of Engineering & Applied Science, Dept. of Chemical Engineering, *1200 University Ave., Boulder, Colorado* 80302 (NAGW 156)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0014, WAVE MECHANISM IN SPACE PLASMA DRIVEN BY NON-MAXWELLIAN DISTRIBUTIONS
V.L. Patel, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (NAGW 158)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0015, HIGH CARRIER DENSITY EFFECTS
F.J. Bartoli, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN080078)

To understand the effects of intense optical radiation on the optical and transport properties of semiconductors and to explore new semiconductor device concepts and processing techniques based on that understanding. Calculations and measurements of saturation of absorption for a variety of detector materials will be made to determine the feasibility of exploiting this effect for optical CCM.

A systematic investigation of the optical and transport properties of optically excited semiconductors will be conducted experimentally and theoretically. Initial emphasis will be placed on the abrupt changes in optical absorption which occur for wa- on the abrupt changes in optical absorption which occur for wavelengths near the fundamental edge. Areas of research to be stein shift, i.e., filling of states in the conduction and valence bands, band-gap renormalization resulting from carrier interactions and free carrier absorption. Intrinsic limitations on the degree of absorption saturation achievable will be examined, including the role of absorption by photo-excited carriers, especially interband hole absorption. Narrow-gap semiconductors such as InSb and HgCdTe will be emphasized.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0016, PLASMA THEORY
T. Coffey, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980032)

The LINUS program at NRL is attempting to apply imploding liner flux compression techniques and advanced plasma source techniques to the generation and confinement of high energy density plasmas. Such techniques have application to high pulsed power generation, nuclear fusion and nuclear weapons effects simulation. NRL has developed techniques for stabilized liner implosions in which the liner motion is contractible and reversible. This is in contrast to the more conventional explosively driven liners. The objective of the present program is to provide the theoretical support needed for the interpretation of experimental results and their extrapolation to larger systems.

This project will utilize advanced techniques in plasma physics and fluid mechanics for modeling the dynamics of imploding liners, liner magnetic field interface and the properties of liner compressed plasmas. The program will be significantly integrated with on-going experimental activities at NRL.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0017, ANALYTICAL CLOUD PHYSICS
W.A. Hoppel, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN480215)

Provide new and improved capabilities to the Navy in overcoming operational difficulties caused by hazardous environmental conditions and in using the environment to an advantage. Achieve a better understanding of cloud and fog dynamics, nucleation, glaciation, condensation, atmospheric electrification, pollution, atmospheric radioactivity, and atmospheric particulates.

Perform interrelated laboratory, field, and modeling experiments and develop the theoretical tools necessary to explain and predict the observed results. Field experiments include the use of aircraft, ships, and ground field sites as platforms for data acquisition. The data acquired from laboratory and field investigations are analyzed and compared to the predictions of current theoretical models with the aim of improving these models and our understanding of atmospheric physics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0018, LARGE BEAM/PLASMA INTERACTION EXPERIMENT (SEEBIE)
A.E. Robson, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN320102)

The primary objective of the SEEBIE electron beam/plasma interaction experiment is to assess the usefulness of high-current relativistic electron beams for heating and preheating large volumes of plasma which could be used in soft X-ray radiation generators. A secondary objective is to study and reach a full understanding of the interaction of relativistic electron beams with relatively dense plasmas. An understanding of these interactions will provide the basis for further advances in the field of electron and ion beam weapons.

A high energy beam of electrons (100 kA, 1.2 MEV, 100 nsec) is injected into a plasma and a study is made of progress which converts the beam energy into plasma thermal energy and magnetic energy.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0019, INVESTIGATION OF COMPOSITION AND DYNAMICS OF THE JOVIAN MAGNETOSPHERE
S.M. Krimigis, Johns Hopkins University, Applied Physics Lab., *Johns Hopkins Rd., Laurel, Maryland* 20810 (NAGW 154)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0020, A PROGRAM OF EXTENDED ANALYSIS OF VOYAGER PLASMA DATA WITH SPECIAL EMPHASIS ON RESULTS OBTAINED AT JUPITER ENCOUNTER
H.S. Bridge, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAGW 165)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0021, WATER QUALITY MEASUREMENTS THROUGH USE OF NIMBUS 7 COASTAL ZONE COLOR SCANNER DATA
M. Sydor, University of Minnesota, Duluth Campus, School of Letters & Science, Dept. of Physics, *331 Science, Duluth, Minnesota* 55812 (NAG 3-165)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

8.0022, ANALYSIS OF JOVIAN ATMOSPHERIC MOTIONS
R.F. Beebe, New Mexico State University, Las Cruces Campus, School of Arts & Sciences, Dept. of Astronomy, *University Park, Las Cruces, New Mexico* 88003 (NAGW 167)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0023, ROOM TEMPERATURE SUPERCONDUCTION IN ORGANIC SOLIDS AND BIOLOGICAL SYSTEMS
F.W. Cope, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN881427)

To obtain experimental evidence for superconduction in organic solids of biological orgin and in living systems and in other organic solids. This may point the way to the development of room temperature plastic superconducting wire for major reductions of size and weight of naval electrical machinery or computers and of sensitive magneto-detectors.

Superconduction in organic solids at high temperatures was predicted over 20 years ago but experimental observation of this was delayed until five years ago when probable superconduction was demonstrated in the bile acids and a probable Josephson effect was seen in carbon films at room temperature. Evidence was obtained by Cope for superconduction in living systems. Experimental evidence of superconduction in solids of biological origin and in living systems and in other organic solids at temperatures as high as room temperature will be sought by new methods. This may provide information regarding choice of material for later fabrication of plastic wires which superconduct at room temperature, which may make practical the construction of naval electrical machinery of much less size and weight because of the absence of heat generation in the superconducting wire. Superconducting computers, magneto-detectors and microwave detectors may then also become practical because of the removal of the need for refrigeration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

8.0024, SPECTROSCOPIC INVESTIGATION OF THE SPECIES EMITTING DIFFUSE LIGHT IN JOHNSON SPACE CENTER SOLAR PANEL PLASMA EFFECTS SIMULATION

D.C. Warren, Houston Baptist University, School of Science & Health Professions, Dept. of Chemistry, *7502 Fondren Rd., Houston, Texas* 77036 (NAG 9-16)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

8.0025, JUPITER DATA ANALYSIS - A SEARCH FOR MAGNETIC ANOMALY EFFECTS

A.J. Dessler, Rice University, Wiess School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (NAGW 166)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0026, ROTATIONAL AND CONVECTIVE PLASMA FLOW IN THE JOVIAN MAGNETOSPHERE

T.W. Hill, Rice University, Wiess School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (NAGW 168)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

8.0027, FISSION PRODUCTS IN THE EARTH'S CRUST

H.E. Hall, Sam Houston State University, School of Sciences, Dept. of Physics, *Huntsville, Texas* 77340 (X-313)

The objective of this work is to determine quantitatively the effect of cosmic radiation on the distribution of fission products in the earth's crust produced by cosmic ray-produced neutrons interacting with heavy elements, e.g., uranium, in the crust.

The neutron activation method to measure the isotopic ratio of 151Eu/153Eu in unseparated geologic samples previously developed during this grant was investigated more thoroughly. Calculations were made of this ratio as a function of time for impulse and continuous neutron sources. Measurements of a powered sandstone and a 5/9th's pure Nd sample gave ratios of 8.65 plus or minus 1.03 and 10.37 plus or minus 0.30, respectively, for time periods of 3.87 and 8.65 years, respectively, after activation, agreeing to within the allowed statistical variations with the calculated values. Using a 14-hour activation in a 10 to the 12th power n/sq. cm/sec. neutron flux and a Ge detector, the method can be used for concentrations down to approximately one ppm, assuming that the sample is thin and that correction for the Lu content is made.

Equipment has been assembled for operation of a Ge detector underground for the purpose of measuring naturally occurring Sn X-rays as a function of depth in a salt mine.

SUPPORTED BY Robert A. Welch Foundation

8.0028, PROPAGATION OF SOUND THROUGH THE EARTH'S ATMOSPHERE

J.E. Becher, Old Dominion University, School of Sciences & Health Professions, Dept. of Physics, *P.O. Box 6173, Norfolk, Virginia* 23508 (NAG 1-142)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0029, HIGH RESOLUTION SCANNING AUGER SPECTROSCOPY ON ADVANCED TURBINE BLADE MATERIALS

J.T. Dickinson, Washington State University, School of Arts & Sciences, Dept. of Physics, *Administration Bldg., Room 101, Pullman, Washington* 99163 (NCC 2-118)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, SUPPORT FOR PREPARATION OF PLANETARY SCIENCE AND THE LUNAR AND PLANETARY LABORATORY BOOK ON VENUS

D.M. Hunten, University of Arizona, School of Liberal Arts, Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (NAGW 149)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0002, SOLAR FLARES STUDY

H. Zirin, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (DF248780; F19628-77-C-0106)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions of AF communications and detection systems. Objective - to develop techniques for improving predictions of solar flares. How research contributes -provides a better understanding of the flare process and the energy release mechanism; this result is an integral part of the development of new prediction techniques.

Simultaneous optical, X-ray and microwave observations of flares will enable the construction of empirical models which specify the magnetic field configuration and the state and evolution of the flare plasma. Such information will place constraints on the timing, location and mode of energy release. Filament eruptions will be studied to find the origin of the pre-flare instability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

10.0003, EVOLUTION OF FE ABUNDANCE IN CLUSTERS OF GALAXIES

S. Lea, California State University & Colleges, San Francisco State University, Graduate School, *1600 Holloway Ave., San Francisco, California* 94132 (NAG 8-385)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

10.0004, SOLAR FLARE MECHANISMS - THEORY AND OBSERVATIONS DURING THE EARLY SOLAR MAXIMUM PERIOD

R.C. Canfield, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (DF044440; AFOSR-76-3071)

AF function - Air Force communications and spacecraft operations are affected by disruptions in near-earth-space produced by solar flares. Deficiency - improved prediction of solar flares is required. Objective - to understand the behavior of the sun's photosphere, chromosphere and corona during solar flares. Contribution -understanding the physical conditions in solar flares throughout the solar atmosphere represents a rational approach to the problem of improving solar flare prediction. This work will enable fast particles at the flare site to be detected and to be related quantitatively to readily observable signatures in line and continuum radiation.

This work will coincide with the first year of NASA's Solar Maximum Mission (SMM) spacecraft and with the period of maximum solar activity itself. Ground and space observations will be made of indicators of flare mechanisms from the photosphere to the corona. Observations of temperature-minimum levels of the solar atmosphere will be made in ultraviolet from the SMM spacecraft and in the visible wavelength region from Sacramento Peak Observatory (SPO). Hydrogen-alpha observations will be made from SPO as a probe of the solar chromosphere during flares, where processes differ from those at temperature-minimum. Theoretical hydrodynamic flare modeling will study the relationship between input parameters and the response of the flaring atmosphere by varying the coronal density

and the form and magnitude of heating. Diagnostic information such as coronal and transition region emission measures, chromospheric line intensities and profiles and velocity as a function of temperature will be computed in order to compare model predictions with observations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

10.0005, STELLAR OBSERVATIONS WITH THE VOYAGER EXTREME ULTRAVIOLET OBJECTIVE GRATING SPECTROGRAPH
D.C. Barry, University of Southern California, School of Letters Arts & Sciences, Dept. of Astronomy, *3551 University Ave., Los Angeles, California* 90007 (NAGW 147)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0006, MAGNESIUM OBSERVATIONS OF A YOUNG CLUSTER
T. Simon, University of Hawaii System, Manoa Campus, Graduate School, *Spalding Hall, Room 359, Honolulu, Hawaii* 96822 (NAG 5-146)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0007, PHOTON AND PARTICLE TRANSFER IN THE COMPACT RADIATION SOURCE IN ACTIVE GALACTIC NUCLEI
J.A. Eilek, New Mexico Inst. of Mining & Technology, Graduate School, *Campus Station, Socorro, New Mexico* 87801 (NCA 2-511101)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

GENERAL

11.0001, SUPPORT OF NASA'S PROGRAM FOR TRANSFER RESEARCH - IMPACT STUDIES
S.D. Johnson, University of Denver, Graduate School, *2115 S. University Blvd., Denver, Colorado* 80210 (NASW 3466)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

11.0002, EDITORIAL ANALYSIS AND REVIEW SERVICES
F.F. Stohrer, Old Dominion University, School of Arts & Letters, Dept. of English, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NAS 1-16537)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N81-26027 Kansas Univ., Lawrence.
A FEASIBILITY STUDY FOR ADVANCED TECHNOLOGY INTEGRATION FOR GENERAL AVIATION Ph.D. Thesis
Garey Takashi Matsuyama 1980 518 p
Avail: Univ. Microfilms Order No. 8111795

Four major efforts of this study included the establishment of an extensive data base; the identification and evaluation of promising new technologies for general aviation; trade studies (design synthesis) for two different airplanes; and modification and utilization of the General Aviation Synthesis Program (GASP) developed by the NASA Ames Research Center. Major tasks included the design of a 6-passenger and 19-passenger aircraft. Dissert. Abstr.

N81-26028*# National Academy of Sciences - National Research Council, Washington, D. C. Assembly of Engineering.
NASA'S ROLE IN AERONAUTICS: A WORKSHOP. VOLUME 1: SUMMARY
1981 71 p refs Workshop held at Woods Hole, Mass., 27 Jul. - 2 Aug. 1980 7 Vol.
(Contracts NASw-3455; NASw-2342)
(NASA-CR-164513) Avail: NTIS HC A04/MF A01 CSCL 01B

The state of the U.S. aeronautic industry and progressive changes in national priorities as reflected in federal unified budget outlays are reviewed as well as the contribution of NACA and the character and substance of U.S. aeronautical research under NASA. Eight possible roles for the future defined by NASA are examined and the extent to which the agency should carry out these activities is considered. The roles include: (1) national facilities expertise; (2) flight sciences research; (3) generic technology evolution; (4) vehicle class evolution; (5) technology demonstration; (6) prototype development; (7) technology validation; and (8) operations feasibility. How NASA's roles varies in the areas of military aviation, general aviation, transport aircraft aeronautics, rotorcraft aeronautics, engineering education, information dissemination, and cooperation with other organizations and agencies is discussed with regard to research in aerodynamics; structures and materials; propulsion; electronics and avionics; vehicle operations; and human engineering. A.R.H.

N81-26029*# National Academy of Sciences - National Research Council, Washington, D. C. Assembly of Engineering.
NASA'S ROLE IN AERONAUTICS: A WORKSHOP VOLUME 2: MILITARY AVIATION
1981 39 p refs Workshop held in Woods Hole, Mass., 27 Jul. - 2 Aug. 1980 7 Vol.
(Contracts NASw-3455; NASw-2342)
(NASA-CR-164514) Avail: NTIS HC A03/MF A01 CSCL 01B

While the National Aeronautics and Space Act of 1958 makes DOD primarily responsible for military aeronautics, it stipulates a role for NASA in providing direct and indirect support for national defense. The existing role of NASA in support of military aeronautics is working well and is well coordinated. The role needs only to be kept effective and then improved by increasing its responsiveness to changing military requirements and by the selective application of additional people. Funding resources should also be made available to NASA for research. Specific roles that NASA could or should play were examined. It was determined that the most important areas for this support are in basic research, generic technology evolution, and facility support in the fields of aerodynamics, structures and materials, and propulsion. A.R.H.

N81-26030*# National Academy of Sciences - National Research Council, Washington, D. C. Assembly of Engineering.
NASA'S ROLE IN AERONAUTICS: A WORKSHOP VOLUME 3: TRANSPORT AIRCRAFT
1981 39 p refs Workshop held at Woods Hole, Mass., 27 Jul. - 2 Aug. 1980 7 Vol.
(Contracts NASw-3455; NASw-2342)
(NASA-CR-164515) Avail: NTIS HC A03/MF A01 CSCL 01B

Segments of the spectrum of research and development activities that clearly must be within the purview of NASA in order for U.S. transport aircraft manufacturing and operating industries to succeed and to continue to make important contributions to the nation's wellbeing were examined. National facilities and expertise; basic research, and the evolution of generic and vehicle class technologies were determined to be the areas in which NASA has an essential role in transport aircraft aeronautics. A.R.H.

N81-26031*# National Academy of Sciences - National Research Council, Washington, D. C. Assembly of Engineering.
NASA'S ROLE IN AERONAUTICS: A WORKSHOP. VOLUME 4: GENERAL AVIATION
1981 36 p refs Workshop held at Woods Hole, Mass., 27 Jul. - 2 Aug. 1980 7 Vol.
(Contracts NASw-3455; NASw-2342)
(NASA-CR-164516) Avail: NTIS HC A03/MF A01 CSCL 01B

A substantially improved flow of new technology is imperative if the general aviation industry is to maintain a strong world position. Although NASA is the most eminently suited entity available to carry out the necessary research and technology development effort because of its facilities, expertise, and endorsement by the aircraft industry, less than 3% of its aeronautical R&T budget is devoted to general aviation aeronautics. It is recommended that (1) a technology program, particularly one that focuses on improving fuel efficienty and safety, be aggressively pursued by NASA; (2) NASA be assigned the role of leading basic research technology effort in general aviation up through technology demonstration; (3) a strategic plan be developed by NASA, in cooperation with the industry, and implemented in time for the 1982 budget cycle; and (4) a NASA R&T budget be allocated for general aviation adequate to support the proposed plan. A.R.H.

N81-26032*# National Academy of Sciences - National Research Council, Washington, D. C. Assembly of Engineering.
NASA'S ROLE IN AERONAUTICS: A WORKSHOP. VOLUME 5: ROTORCRAFT
1981 39 p refs Workshop held at Woods Hole, Mass., 27 Jul. - 2 Aug. 1980 7 Vol.
(Contracts NASw-3455; NASw-2342)
(NASA-CR-164517) Avail: NTIS HC A03/MF A01 CSCL 01B

The potential roles for NASA relating to rotorcraft are reviewed. The agency's participation is delineated for each role, a rationale is provided, the current level of activity is summarized, and suggestions are given for the kinds of research still needed. In examining opportuntites for the most beneficial deployment of its resources, NASA should consider societal benefits as well as the military and civil markets in formulating the role it can play to support the development of a stronger rotorcraft technology base. A.R.H.

N81-26033*# National Academy of Sciences - National Research Council, Washington, D. C. Assembly of Engineering.
NASA'S ROLE IN AERONAUTICS: A WORKSHOP. VOLUME 6: AERONAUTICAL RESEARCH
1981 25 p refs Workshop held at Woods Hole, Mass. 27 Jul. - 2 Aug. 1980 7 Vol.
(Contracts NASw-3455; NASw-2342)
(NASA-CR-164518) Avail: NTIS HC A02/MF A01 CSCL 01B

While each aspect of its aeronautical technology program is important to the current preeminence of the United States in aeronautics, the most essential contributions of NASA derive from its research. Successes and challenges in NASA's efforts to improve civil and military aviation are discussed for the following areas: turbulence, noise, supercritical aerodynamics, computational aerodynamics, fuels, high temperature materials, composite materials, single crystal components, powder metallurgy, and flight controls. Spin offs to engineering and other sciences explored include NASTRAN, lubricants, and composites. A.R.H.

N81-26034*# National Academy of Sciences - National Research Council, Washington, D. C. Assembly of Engineering.
NASA'S ROLE IN AERONAUTICS: A WORKSHOP. VOLUME 7: BACKGROUND PAPERS
1981 185 p refs Workshop held at Woods Hole, Mass., 27 Jul. - Aug. 1980 7 Vol.
(Contract NASw-3455)
(NASA-CR-164519) Avail: NTIS HC A09/MF A01 CSCL 01B

The nature and implications of the current state of U.S. aviation in a world setting are examined as well as their significance for NASA's role in the nation's aeronautical future. The outlook for the 1980's is examined from the point of view of legislation, economics and finance; petroleum; manpower, metallic materials, general aviation; military aviation; transport aircraft developments; and helicopters. Possible NASA assistance to DOD and the FAA is examined and the evolution of NACA and NASA in aeronautics and of NASA's aeronautics capabilities are described. A.R.H.

N81-26035# RAND Corp., Santa Monica, Calif.
A METHOD FOR ESTIMATING THE COST OF AIRCRAFT STRUCTURAL MODIFICATION Interim Report
J. L. Birkler and J. P. Large Mar. 1981 156 p
(Contract F49620-77-C-0023)
(AD-A099327; RAND/R-2565-AF) Avail: NTIS HC A08/MF A01 CSCL 05/1

Research into the cost of aircraft structural modifications is described. Detailed cost and man hour data supplied by the airframe industry permitted derivation of estimating tools for major aircraft components. Separate equations were derived for engineering, tooling, manufacturing, and material cost. The major explanatory variable was always weight. It was hypothesized that structural modification cost could be estimated on the basis of the weight of material added. Estimates of the cost of modification for the B-52, C-141, C-5, and EF-111 were compared with cost data from industry. Considerable informed judgment is required as is a knowledge of such program-specific facts as whether the original production tooling still exists. Rather than a mathematical model, the study describes the kinds of information needed, suggests guidelines, and presents estimating equations for airframe systems and subassemblies. These contribute to an understanding of the estimating problem but do not constitute a general solution. Author (GRA)

N81-26036# Arinc Research Corp., Annapolis, Md.
F-16 RELIABILITY IMPROVEMENT WARRANTY IMPLEMENTATION AND MANAGEMENT PLAN
G. Harrison May 1981 99 p
(Grant F09603-78-G-4125)
(AD-A099303; Rept-1565-21-1-2461) Avail: NTIS HC A05/MF A01 CSCL 15/5

The purpose of this Implementation and Management Plan (IMP) is to provide a complete and comprehensive document that describes the multiple features of the F-16 RIW program, defines the responsibilities for meeting the contractual provisions of the program, identifies the responsible participants, and establishes the procedures and interfaces required for its successful implementation and management. The objective of the IMP is to assist the MFP users in introducing the F-16 RIW items into their inventories with minimum disruption to existing logistic support procedures. Author (GRA)

N81-26037# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
COMPUTATION OF VISCOUS-INVISCID INTERACTIONS
Feb. 1981 524 p refs Symp held at Colorado Springs, Colo 29 Sep. - 1 Oct. 1980
(AGARD-CP-291; ISBN-92-835-0286-8) Avail: NTIS HC A22/MF A01

Computational aircraft performance prediction is considered to be the final goal of aerodynamic research, especially in the field aircraft design. The flow fields generated airfoils were examined with emphasis on the parts of the flow where viscosity plays a major role - the boundary and shear layers. Adequate methods and algorithms to link the viscous and the inviscid parts of the flow were surveyed. Topics addressed include: unseparated flows and the thin-layer concept; turbulent strong interaction without extensive separated flow; and separated flows. For individual titles, see N81-26038 through N81-26068.

N81-26038# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
COMPUTATION OF FLOWS INCLUDING STRONG VISCOUS INTERACTIONS WITH COUPLING METHODS c34
J. C. LeBalleur *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 36 p refs In FRENCH; ENGLISH summary (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

The approximation levels and concepts are outlined, as well as the generalized formulations of the viscous displacement for inviscid flow. The strongly interacting methods that are based on thin viscous layers approximations are discussed. A matching formulation of the viscous flow, calculated as a difference of the inviscid overlaying flow, is presented in order to approximate the normal pressure gradient inside of the layers, as well as to eliminate the supercritical behaviors, in the Crocco-Lees sense. This analysis uses simple viscous integral equations. Numerical techniques presently available for the coupling problem are reviewed. Results are presented for trailing-edge separation, and an approximation method is presented to numerically analyze the viscous interaction under shock waves. T.M.

N81-26039# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
A REVIEW OF METHODS FOR PREDICTING VISCOUS EFFECTS ON AEROFOILS AND WINGS AT TRANSONIC SPEEDS c02
R. C. Lock *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 32 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

Methods in which the problem of viscous-inviscid interaction is treated by assuming that the effects of viscosity are confined to thin boundary layers and wakes are reviewed. With this assumption, an iterative procedure is set up in which the inviscid flow is calculated first and the result used to specify the pressure distribution from which the development of the viscous layers

can be determined. The inner boundary condition for the equivalent inviscid flow is then modified to allow for the displacement effect of the viscous layers; and the procedure is repeated until convergence is obtained. Two alternative mathematical models for the displacement effect were derived, valid to second-order accuracy. The principal methods that are currently available for the two dimensional problem (single airfoils) at transonic speeds and some of the corresponding methods for three dimensional wings or wing body combinations were reviewed. T.M.

N81-26040# Arizona Univ., Tucson.
INVISCID-VISCOUS INTERACTIONS IN THE NEARLY DIRECT DESIGN OF SHOCK-FREE SUPERCRITICAL AIRFOILS **c02**
H. E. Nebeck, A. R. Seebass, and H. Sobieczky (DFVLR, Goettingen, West Germany) *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 10 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

A procedure for finding airfoil shapes that have desirable aerodynamic characteristics and that will be shock free at Mach numbers close to the highest values possible is described. The procedure accounts for overall inviscid-viscous interactions that are weak and includes the locally strong interaction at the trailing edge as incorporated in the Grumfoil algorithm. T.M.

N81-26041# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Aerodynamische Versuchsantalt.
THE COUPLING OF A SHOCK BOUNDARY LAYER INTERACTION MODULE WITH A VISCOUS-INVISCID COMPUTATION METHOD **c02**
E. Stanewsky, M. Nandanan, and G. R. Inger (Virginia Polytechnic Inst. and State Univ.) *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

A brief description of the present method and its components is presented. Results obtained with the combined boundary layer/shock boundary layer interaction code are compared with results from the complete viscous-inviscid method with corresponding data from boundary layer and surface pressure distribution measurements. Present results are, in addition, compared with data obtained by other methods. From the results discussed, it is shown that in transonic airfoil flow analysis it is generally necessary to incorporate a physically correct treatment of the interaction of a shock with the boundary layer. T.M.

N81-26042# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VISCOUS-INVISCID COUPLED CALCULATIONS IN UNSTEADY TWO-DIMENSIONAL INCOMPRESSIBLE AND TRANSONIC FLOW **c02**
A. Desopper and R. Grenon *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 21 p refs In FRENCH; ENGLISH summary (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

A calculation method in which viscous effects were taken into account was developed. It uses: for the inviscid flow calculation, a singularity method in incompressible flow or a small disturbances method in transonic flow; an integral method for the calculation of the unsteady boundary layer; and a coupling technique called 'coupling at the wall' not taking into account the problem of separation. Results obtained by this method are presented: in compressible flow for a supercritical profile with an oscillating flap and for a profile oscillating in pitch; and in transonic flow for a NACA 64 A 006 profile with an oscillating flap. These results show the influence of the viscous effects on the unsteady pressures, on the total force coefficients, on the strength and on the location of the shock waves. T.M.

N81-26043# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
VISCOUS FLOW SIMULATION OF HIGH LIFT DEVICES AT SUBSONIC AND TRANSONIC SPEED **c02**
Stefan Leicher *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 15 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

A numerical method for the calculation of viscous flow over multicomponent airfoils is presented. The part of the code containing the viscous methods is decoupled from the inviscid one in order to be easily combined with any suitable inviscid method. The iterative use of both parts leads finally to a converged solution. The viscous part consists of a one parameter integral method for laminar boundary layers, a modified Nash integral method or the lag-entrainment method of Horton for turbulent boundary layers and a special integral procedure (optional) for confluent boundary layers. Laminar short and long separation bubbles as well as bubble burst were calculated. Transition can be either fixed or calculated using the Reynolds number criterion of Michel. Turbulent separation of bubble type as well as common trailing edge separation were simulated within the standard boundary layer methods by means of semi-empirical correlations. The numerical simulation of the viscous effects is made using either the displacement thickness concept (transonic, subsonic) or the equivalent source approach (subsonic only). T.M.

N81-26044# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
FLOW COMPUTATION AROUND MULTI-ELEMENT AIRFOILS IN VISCOUS TRANSONIC FLOW **c02**
H. Rosch and K. D. Klevenhusen *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 10 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

A singularity method is applied to multi-element airfoils in the physical plane for calculating both, the incompressible velocities and the incompressible potential and stream function along the contour of each element. The values of the computation were used to build an orthogonal grid in which the airfoil is mapped to a line in the streamline plane. The computational domain is this streamline plane wherein the full transonic potential equation is solved using a finite difference method. The influence of viscous effects were incorporated using the so called surface transpiration concept. The representation of the displacement effect of the boundary layer and wakes is based on the well known integral method and a trailing edge flow concept which includes normal pressure gradients and wake curvature effects. Comparisons of the theory with high Reynolds number experiments show the good agreement for pressure distribution and lift. T.M.

N81-26045# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
CALCULATIONS OF TRANSONIC FLOW OVER WING/BODY COMBINATIONS WITH AN ALLOWANCE FOR VISCOUS EFFECTS **c02**
M. C. P. Firmin *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 18 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

A viscous inviscid interaction scheme developed for aerofoils was generalised to account for the three dimensional effects of the boundary layers and wake over the wing of a wing/body combination. Two main elements make up the method: the RAE Mk 4 transonic small perturbation method which was modified to allow changes to be made to the boundary conditions over the wing and in the wake; and a three dimensional integral boundary layer method. The coupling of the two main elements of the method and the difficulties encountered in providing an adequate iterative scheme are discussed. Computing times are discussed in relation to the time required for the basic calculation for inviscid flow. Several examples are given of results obtained and comparisons are shown between experimental measurements and results from the scheme. T.M.

N81-26046# Boeing Military Airplane Development, Seattle, Wash.
PLANAR TRANSONIC AIRFOIL COMPUTATIONS WITH VISCOUS INTERACTIONS **c02**
J. C. Wai and H. Yoshihara *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 9 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

Green's lag entrainment integral boundary layer and wake equations are coupled to a transonic small disturbance potential equation to calculate flows with shock induced and aft separations. The shock boundary layer interactions is treated phenomenologically by incorporating a wedge ramp at the base of the shock to achieve an empirically defined post shock pressure. The remainder of the boundary layer and wake are treated by a coupled scheme where the boundary layer equations are used as boundary conditions along the airfoil and wake for the inviscid flow calculation. The procedure is illustrated for the case of the NASA Supercritical Airfoil 12 without separation and the case of the RAE 2822 with shock induced separation. T.M.

N81-26047# Grumman Aerospace Corp., Bethpage, N.Y.
TURBULENT INTERACTIONS ON AIRFOILS AT TRANSONIC SPEEDS: RECENT DEVELOPMENTS c02
R. E. Melnik *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 34 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

Developments in theoretical concepts for the analysis of viscid inviscid interactions on airfoils at transonic speeds are discussed. The overall weak interaction between the boundary layer, wake and outer inviscid flow are considered as well as the strong local interaction at shock waves and trailing edges. Efforts to incorporate important wake displacement and wake curvature effects into an interacting boundary layer formulation are discussed. Progress in the development of local, large Reynolds number, asymptotic solutions for turbulent shock wave boundary layer and trailing edge interaction are described and related to Lighthill's two layer model of strong interactions. Reasons for the difference between laminar and turbulent strong interaction theories are discussed. Techniques are described for incorporating the local trailing edge solution into an interacting boundary layer formulation which includes a complete treatment of the wake. Theoretical predictions, obtained with this formulation, are compared with wind tunnel data to illustrate the accuracy that can be achieved with an interacting boundary layer formulation when the wake and trailing edge interaction effects are included in the theoretical model. R.C.T.

N81-26048# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
COMPUTATION OF VISCOUS FLOWS OVER AIRFOILS, INCLUDING SEPARATION, WITH A COUPLING APPROACH c02
J. C. LeBalleur and M. Neron *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 15 p refs In FRENCH; ENGLISH summary (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

Viscous incompressible flows over single or multiple airfoils, with or without separation, were computed using an inviscid flow calculation, with modified boundary conditions, and by a method providing calculation and coupling for boundary layers and wakes, within conditions of strong viscous interaction. The inviscid flow is calculated with a method of singularities, the numerics of which were improved by using both source and vortex distributions over profiles, associated with regularity conditions for the fictitious flows inside of the airfoils. The viscous calculation estimates the difference between viscous flow and inviscid interacting flow, with a direct or inverse integral method, laminar or turbulent, with or without reverse flow. The numerical method for coupling determines iteratively the boundary conditions for the inviscid flow. For attached viscous layers regions, an underrelaxation is locally calculated to insure stability. For separated or separating regions, a special 'semi-inverse' algorithm 's used. Comparisons with experiments are presented. A.R.H.

N81-26049# National Aerospace Lab., Amsterdam (Netherlands).
THE CALCULATION OF INCOMPRESSIBLE BOUNDARY LAYERS WITH STRONG VISCOUS-INVISCID INTERACTION c34
A. E. P. Veldman *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 12 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

A quasisimultaneous method is described to calculate laminar, incompressible boundary layers interacting with an inviscid external flow. The essence of the method is the numerical treatment of the interactive boundary condition which models the behaviour of the outer flow; it is regarded as a relation between the pressure and the displacement thickness where both quantities are simultaneously treated as unknowns. This way the method avoids difficulties incurred when either direct or inverse methods are used, resulting in fast convergence of the iterative procedure involved. R.C.T.

N81-26050*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A VISCOUS-INVISCID INTERACTION MODEL OF JET ENTRAINMENT c34
R. G. Wilmoth and S. M. Dash (Aeronautical Research Associates of Princeton, Inc.) *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 15 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01 CSCL 20D

A viscous-inviscid interaction model for predicting jet entrainment effects on axisymmetric, nozzle afterbodies at subsonic speeds is presented. The model is based on a displacement thickness correction to the inviscid jet boundary that accounts for mixing-induced streamline deflections in the inviscid region. The displacement correction is shown to be related to the local mass entrainment rate and, for thin mixing layers, the model is shown to be analogous to displacement models used in conventional boundary-layer interaction theory. A method is presented for computing the entrainment rate by an overlaid mixing layer model that accounts for the nonsimilar behavior and pressure gradients occurring in the near field region. An iterative scheme for coupling the model to analyses for the external inviscid flow, the external boundary layer, and the inviscid jet exhaust is also given. Results are presented that illustrate the qualitative behavior of the entrainment interaction under various flow conditions and that demonstrate the validity of the model by comparisons with experiment. R.C.T.

N81-26051# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Aerothermodynamique.
THE ANALOGY OF SINGULARITIES IN DIRECT METHODS FOR CALCULATING STEADY THREE DIMENSIONAL AND UNSTEADY TWO DIMENSIONAL BOUNDARY LAYERS: ANALYSIS OF REVERSED MODES [ANALOGIE DES SINGULARITES DANS LES METHODES DIRECTES DE CALCUL DES COUCHES LIMITES TRIDIMENSIONNELLE STATIONNAIRE ET BIDIMENSIONNELLE INSTATIONNAIRE: ANALYSE DES MODES INVERSES] c34
J. Cousteix and R. Houdeville *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 p refs In FRENCH; ENGLISH summary (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

The problem of occurrence of singularities in boundary layer equations, both in the unsteady two-dimensional and steady three-dimensional cases, is analytically studied by means of the global equations of momentum and entrainment. In the direct mode the velocity is given. It is shown that in opposition to the steady two-dimensional case, the occurrence of reversed flows does not generally create singularities, but indicates a downstream influence. In both cases, the analytical and numerical study shows that discontinuity lines can exist, corresponding to weak solutions of the equations, but these lines have no physical meaning. Particularly in the three-dimensional case they must not be confused with separation lines. The calculations in the inverse mode avoid any singularity. The velocity is then an unknown of the boundary layer problem. Such methods are useful to solve the coupling problem between viscid-inviscid flow and are also interesting to verify closure relations of calculation models in separated regions. Author

N81-26052# Flow Research, Inc., Kent, Wash.
A PHENOMENOLOGICAL MODEL FOR DISPLACEMENT THICKNESS EFFECTS OF TRANSONIC SHOCK WAVE-BOUNDARY LAYER INTERACTIONS c02
Wen-Huei Jou and Earl M. Murman *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 p refs (For primary document see N81-26037 17-01)

Avail: NTIS HC A22/MF A01

A simple algebraic model is developed to describe the shape the viscous displacement thickness surface downstream of a weak normal shock wave (M sub 1 less than 1.3) interacting with a turbulent boundary layer. Theoretical information is used to construct the shape of a bump. The bump is then incorporated into inviscid transonic potential codes to model the strong interaction effects of the boundary layer in moving the shock wave forward and reducing its strength. Computed results compare favorably with two and three dimensional experiments. R.C.T.

N81-26053*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.

SIMPLE APPROXIMATIONS FOR THE ASYMPTOTIC DESCRIPTION OF THE INTERACTION BETWEEN A NORMAL SHOCK WAVE AND A TURBULENT BOUNDARY LAYER AT TRANSONIC SPEEDS c02

T. C. Adamson, Jr. and A. F. Messiter *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 p refs (For primary document see N81-26037 17-01)
(Grant NsG-1326)
Avail: NTIS HC A22/MF A01 CSCL 01A

The asymptotic description of the interaction between a normal shock wave and a turbulent boundary layer is reviewed. The layers necessary in a rational analysis of the interaction are discussed with emphasis on the differences from an interaction with a laminar boundary layer, the uncoupling of solutions for the distribution of pressure and skin friction at the wall, and the role of the Reynolds shear stress in these solutions. The accuracy of asymptotic solutions in flows at Reynolds numbers of technical interest is discussed. Solutions for the distribution of pressure and skin friction at the wall and the shape of the shock are considered for the case where the flow is near separation. For the pressure and skin friction, it is possible to write two simplified partial solutions, one valid at the beginning of the interaction and one valid somewhat downstream of the shock wave. A solution composed of these two parts and a linear interpolation between them appears to give good comparison with experiment; one unknown constant, independent of the parameters of the interaction, must be found from experiment. The simplified relations are presented. Comparison of numerical computations with experimental data indicates a possible value for the constant and shows quite satisfactory results. R.C.T.

N81-26054# Karlsruhe Univ. (West Germany). Inst. fuer Stroemungslehre und Stroemungsmaschinen.

NORMAL SHOCK-TURBULENT BOUNDARY LAYER INTERACTION c34

R. Bohning and J. Zierep *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 8 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

A survey on investigations of the interaction between a weak normal shock and a two dimensional compressible turbulent boundary layer is presented. The theoretical results are compared with some measurements. An analytical model is presented which includes three domains: a thin viscous sublayer (which is different from the laminar sublayer) adjacent to the wall; an inviscid shear layer; and an inviscid transonic potential flow. With regional solutions in closed form, which are coupled iteratively, the pressure and velocity distribution in the boundary layer is obtained. The thickness of the viscous sublayer is an essential parameter of the whole interaction problem. A characteristic behavior of the gradient of the wall-shear-stress in flow direction is used to determine the thickness parameter. The result is confirmed by another independent analytical solution which we have derived recently using the method of matched asymptotic expansions. The theory includes the prediction of the incipient shock induced separation as a limiting case. With the condition of vanishing wall-shear-stress an analytical criterion follows from the explicit solution near the wall. A diagram is presented which yields the combination of Mach number and Reynolds number which will result in separation for a given wall curvature and shape factor of the undisturbed velocity profile. R.C.T.

N81-26055# Virginia Polytechnic Inst. and State Univ., Blacksburg.

SOME FEATURES OF A SHOCK-TURBULENT BOUNDARY LAYER INTERACTION THEORY IN TRANSONIC FLOW FIELDS c02

G. R. Inger *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 26 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

The features of an approximate nonasymptotic triple deck theory of shock turbulent boundary layer interaction that accurately describes nonseparating two dimensional flows over a wide range of practical Reynolds numbers are described and its application as an element in the overall viscous flow analysis of the body is demonstrated. Two main aspects of the problem are examined: (1) the local interactive thickening and skin friction drop in the shock foot region, including the effects of the incoming boundary layer shape factor, wall curvature, an improved viscous ramp model of the interaction and an approximate prediction of incipient separation behavior, and (2) the significant influence of such interaction on the subsequent downstream turbulent boundary layer thickening, profile shape and skin friction behavior. Comparisons with experimental data are given and applications presented for both supercritical airfoils and transonic bodies of revolution. R.C.T.

N81-26056# National Aerospace Lab., Amsterdam (Netherlands).

COMPUTATIONAL ASPECTS AND RESULTS OF LOW SPEED VISCOUS FLOW ABOUT MULTICOMPONENT AIRFOILS c02

B. Oskam *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

The viscous flow about multicomponent airfoils were calculated solving incompressible potential flow and boundary layer problems iteratively. The presence of the shear layers was modeled in the potential flow by an outlaw boundary condition on the airfoil surface and the wake centerline. Example solutions show that high accuracy of the potential flow solution is required to justify the correction for viscous effects, especially near the wing trailing edge of a slotted configuration. The phenomenon of leading edge stall was also investigated. Turbulent boundary layer separation at 3 per cent chord, downstream of a laminar separation bubble, was found on the nose of a NACA 63-009 airfoil at high Reynolds number indicating the occurrence of turbulent leading edge stall. This phenomenon, being difficult to distinguish from laminar edge (short bubble) stall, occured at such a small scale that it is observed only if one obtains high resolution results. The importance of the wing wake of a slotted configuration was also examined. The results agree reasonably well at moderate angles of attack. At higher angles of attack it was found that the wing wake streaming along the upper surface of the flap is subjected to a large adverse pressure gradient. The associated extreme growth of the displacement thickness of the wing wake was found to be the major item determining the loss of lift due to viscous effects. R.C.T.

N81-26057# Douglas Aircraft Co., Inc., Long Beach, Calif. Aerodynamics Research.

SEPARATION AND REATTACHMENT NEAR THE LEADING EDGE OF A THIN AIRFOIL AT INCIDENCE c02

Tuncer Cebeci, Keith Stewartson (University Coll., London), and P. G. Williams (University Coll., London) *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 13 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

The leading edge separation which occurs on thin airfoils with increasing angles of attack was calculated. A general method was developed in order to solve the simplified problem of a parabola at incidence. The boundary layer equations were solved, in finite difference form, with the Mechul method to allow the determination of the external velocity distribution and a Hilbert integral to allow the modification of the external velocity distribution by the displacement thickness. The results indicate, that if the separation is laminar, reattachment occurs in a very limited range of the reduced angle of attack. With prescribed transition, and an algebraic eddy viscosity formulation, the trend of the results are in line with experiment and help to confirm that the solution method is appropriate for application to real airfoil geometries. R.C.T.

N81-26058# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Aerothermodynamique.
THE LAMINAR SEPARATION WITH TRANSITION BUBBLE [BULBE DE DECOLLEMENT LAMINAIRE AVEC TRANSITION: ESSAI DE PREVISION AVEC COUPLAGE LOCAL] **c02**
C. Gleyzes, J. Cousteix, and J. L. Bonnet *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 16 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

Experimental results of a study of a leading edge separation bubble on a peaky airfoil are presented. Boundary layer measurements, mean velocity, and longitudinal turbulence intensity were carried out for several values of Reynolds number (10 to the 5th power < R sub c < to 10 to the 6th power). The transition process in a long bubble was also studied. Two calculation methods for short bubble are proposed. Both use a simple local viscid-inviscid interaction scheme. These results are compared to experimental results. A.R.H.

N81-26059# Stanford Univ., Calif. Dept. of Mechanical Engineering.
THE 1980-81 AFOSR-HTTM-STANFORD CONFERENCE ON COMPLEX TURBULENT FLOWS: COMPARISON OF COMPUTATION AND EXPERIMENT **c34**
S. J. Kline *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 22 p refs (For primary document see N81-26037 17-01)
(Contract F49620-80-C-0027)
Avail: NTIS HC A22/MF A01

The goals of the conference are described as: (1) to reach consensus in the research community on trustworthy data sets that can be used as input for modeling of turbulence in complex flows and as the basis for standard trials for checking output of computations; (2) the creation of a data library on magnetic tape; and (3) comparison of the output of current methods of computation for turbulent flows for a set of basic test cases covering a broad range of flows. A discussion of some current difficulties in turbulence research and fluids engineering and a description of the conference and how it plans to ameliorate some of the difficulties are included. E.D.K.

N81-26060# Ruhr Univ., Bochum (West Germany). Inst. fuer Thermo- und Fluiddynamik.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF TWO DIMENSIONAL FLOWS WITH SEPARATED REGIONS OF FINITE LENGTH **c34**
K. Gersten, H. Herwig, and P. Wauschkuhn *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 13 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

Theoretical and experimental investigations of two dimensional incompressible flows containing separated regions of fluid length were conducted. Separation of both laminar and turbulent boundary layers were considered. In the case of laminar separation it was assumed that the separated free shear layer remains laminar. The separation bubbles were originated by backward facing steps with sharp or rounded edges or by dents in a flat plate. The flow along a flat plate having a backward facing step with sharp or rounded edges was generalized to flows in channels with sudden enlargements or to flows in diffusors, respectively. In all cases considered the theoretical modelling of the flow fields has taken into account the strong mutual viscous inviscid interaction between outer flow and separated flow region. All flow problems considered depend essentially on two or more independent Reynolds numbers. E.D.K.

N81-26061# Sandia Labs., Livermore, Calif.
TWO DIMENSIONAL SEPARATED FLOW: EXPERIMENT AND DISCRETE VORTEX DYNAMICS SIMULATION **c34**
W. T. Ashurst, F. Durst (Karlsruhe Univ.), and C. Tropea (Karlsruhe Univ.) *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 13 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

A laser Doppler anemometer (LDA) was used to measure the time averaged flow properties and their fluctuations in an open water channel test section. Experimental results include the flow and normal direction velocities (mean and root mean square), Reynolds shear stress, and separated flow length. The variation of the reattachment location was also obtained as a function of Reynolds number and flow expansion ratio. Flow visualization was employed to gain further understanding of the flow structure. Numerical results obtained with a method known as discrete vortex dynamics are described. This method provides a Lagrangian description of fluid flow in which the distribution of vorticity is discretized and its time dependent motion is calculated. Thus, unsteady flow phenomena can be included within this time dependent computational method. E.D.K.

N81-26062# Royal Aircraft Establishment, Farnborough (England).
THE DEVELOPMENT AND APPLICATION OF A METHOD FOR CALCULATING THE VISCOUS FLOW ABOUT HIGH LIFT AEROFOILS **c02**
D. J. Butter (British Aerospace Aircraft Group, Stockport, England) and B. R. Williams *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 20 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

Methods for calculating each region of the flow and which are combined by an iterative procedure were developed. This modular approach means that improved approximations in a particular region can be easily inserted into the system. The method was programmed so that the calculations can be made in a wind tunnel and prediction compare well with the measurement of two dimensional flow on high lift wings. Applications of this method permit the effective design of the leading edge slat, slat/wing cut profiles, wing upper surface shrouds, and trailing edge flaps. It can be further used in the design of a flap system to optimize the gap and overlap of the various elements and also their deflection angles. E.D.K.

N81-26063*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
A DIRECT INVERSE TECHNIQUE FOR LOW SPEED HIGH LIFT AIRFOIL FLOWFIELD ANALYSIS **c02**
Leland A. Carlson *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 10 p refs (For primary document see N81-26037 17-01)
(Grant NsG-1174)
Avail: NTIS HC A22/MF A01 CSCL 01A

A direct inverse method is presented for computing the flow about low speed airfoils under high lift massive separation conditions. On the lower surface the flowfield is determined using an iterative inviscid relaxation technique coupled to a laminar turbulent momentum integral boundary layer scheme direct boundary conditions. On the upper surface, the flowfield is also computed directly with viscous interaction up to the separation point, with the separation point and separated pressure level determined as part of the solution. Downstream of separation, inverse boundary conditions are utilized; and the flowfield and displacement surface are calculated. Typical results and comparisons with experimental data for GA(W)-2 and NACA 4412 airfoils are presented, including pressure distributions, lift, and drag coefficients versus angle of attack. E.D.K.

N81-26064# Bari Univ. (Italy). 1st. di Machine.
A SECOND ORDER ACCURATE NUMERICAL METHOD FOR SUPERSONIC INTERACTING BOUNDARY LAYER FLOW PAST A COMPRESSION CORNER **c02**
Bernardo Fortunato *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

The supersonic interacting boundary layer equations are solved for laminar flow past a configuration with an interior compression corner region. The approach employs conformal coordinates to map the body geometry into stagnation point flow and uses the boundary layer scale laws to identify the principal terms of the compressible counterpart of the Navier-Stokes equations. A Levy-Lees type transformation is used in these coordinates to simplify the governing equations. The viscous-inviscid interaction law is given by evaluating the small perturbation theory inviscid flow past the displacement body obtained as the sum of the body surface plus the viscous displacement thickness. A fictitious

time dependent term is introduced in the governing equations, that are then relaxed using an alternating direction implicit technique. The numerical scheme is second order accurate in both the longitudinal and normal directions. E.D.K.

N81-26065# Centre d'Etudes Aerodynamiques et Thermiques, Poitiers (France).
COMPUTATION OF THE SHOCK-WAVE BOUNDARY LAYER INTERACTION WITH FLOW SEPARATION c02
P. Ardonceau, Th. Alziary (Poitiers Univ.), and D. Aymer *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 16 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

A method to compute the shock wave-boundary layer interaction is presented. The boundary layer concept is used to describe the viscous flow near the wall and the outer inviscid flow is calculated by a pressure turning relation for simplicity. The boundary layer equations are solved in finite difference form and the question of the existence and unicity of the solution is examined for the direct or inverse problem. From the aforementioned analysis together with viscous-inviscid matching considerations a particular choice is made for the matching variable. An algorithm is presented to converge the matched solution which implicitely includes the downstream condition necessary to close the interacting boundary layer problem. The algorithm makes use of a Newton linearization technique which is shown to provide a fast convergence. E.D.K.

N81-26066# Bari Univ. (Italy). 1st di Machine.
TOWARD A SPLINE TECHNIQUE FOR THE HIGH REYNOLDS NUMBER INTERACTION (TRIPLE DECK) PROBLEM c02
M. Napolitano and G. Vacca *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 15 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

The numerical solution of the asymptotic triple deck equations for supersonic as well as subsonic flow conditions is considered. The need for higher order numerical accuracy is pointed out and the fundamental steps necessary for developing a high order numerical method for the triple deck equations are followed thru. A fourth order accurate spline Cauchy integral solver is presented and an interesting matrix singularity problem connected with such a problem is analyzed. The intrinsic instability of spline techniques, as applied to the time-like variable for the case of parabolic partial differential equations, is removed and a procedure particulary suitable partial differential equations, is removed and a stable procedure particularly suitable for the triple deck (or interacting boundary layer) equations is presented and verified for a simple model problem. The logical steps necessary for combining all the above into a fourth order accurate spline triple deck solver are indicated. E.D.K.

N81-26067# Royal Aircraft Establishment, Farnborough (England). Aerodynamic Dept.
A THEORY OF THE SEPARATED FLOW PAST A SLENDER ELLIPTIC CONE AT INCIDENCE c02
S. P. Fiddes *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 p refs (For primary document see N81-26037 17-01) Avail: NTIS HC A22/MF A01

A method was been developed for calculating the laterally symmetric separated flow past a slender elliptic cone at incidence, including the calculation of the position of the separtion line when the boundary layer is laminar. The method falls into two parts; a vortex sheet model for the outer inviscid separated flow and a triple-deck model of the viscous-invsicid interaction of this external flow with a laminar boundary layer on the cone. A uniformly valid representation of the vortex sheet is adopted, which represents a considerable advance on previous techniques for calculating vortex sheets using slender body theory. The method is capable of calculating the shape of the cortex sheet, its vorticity distribution, the pressure distribution over the cone, etc. for an elliptic cone of arbitrary cross sectional eccentricity at incidence with specified, symmetric, separation positions. E.D.K.

N81-26068*# Analytical Methods, Inc., Bellevue, Wash.
PREDICTION OF AERODYNAMIC CHARACTERISTICS FOR WINGS WITH EXTENSIVE SEPARATIONS c02
B. Maskew, B. M. Rao, and F. A. Dvorak *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 15 p refs (For primary document see N81-26037 17-01)
(Contracts NAS2-8788; N00014-78-C-0128; DAAG29-76-C-0019; DAAJ02-75-C-0036)
Avail: NTIS HC A22/MF A01 CSCL 01A

The development of a simple yet effective technique for modelling the effects of trailing edge separation is discussed. The model encloses the low energy region with free vortex sheets coupled with a potential flow panel method. The technique includes an interation cycle between viscous and potential flow routines and its development from the two dimensional case to the three dimensional case is discussed. A description of the potential flow panel method, which is based on an internal Dirichlet boundary condition, is included. E.D.K.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N81-26069 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A SINGULAR PERTURBATION METHOD FOR ARBITRARY CONFIGURATIONS IN SUBSONIC POTENTIAL FLOW
Frederick Morgan Jonas 1980 107 p
Avail: Univ. Microfilms Order No. 8106925

A method is developed for obtaining uniformly valid solutions about slender bodies (2-D or 3-D) with round leading/trailing edges in compressible subsonic flow. The method is based on the principles of singular perturbation theory and applied to nonlifting thickness problems. The method corrects small perturbation theory (outer solution) with a stagnation region theory (inner solution) yielding uniformly valid solutions. Analytic results of the first and second order method are presented and compared to other methods, including exact numerical results, for the elliptic cylinder. The ability to correctly model the flow behavior in stagnation regions using the composite solutions leads to a greater confidence in aerodynamic predictions, especially inviscid drag estimates. Dissert. Abstr.

N81-26070 Virginia Polytechnic Inst. and State Univ., Blacksburg.
NONPARALLEL STABILITY OF THREE-DIMENSIONAL FLOWS Ph.D. Thesis
Atul Ramesh Padhye 1980 140 p
Avail: Univ. Microfilms Order No. 8110471

An analysis of linear stability of three dimensional boundary layer flows is presented. Both temporal and spatial stabilities are considered. The method of multiple scales is used to account for the nonparallelism of the mean flow, and to derive amplitude and wave-number modulation equations. The wavenumber modulation equation is used to develop a formal method for obtaining neutral stability. The amplitude modulation equation is used to develop a transformation relating the temporal and spatial stabilities. In the case of three dimensional flows, the calculations are performed in temporal stability which is then transformed to be the spatial along the direction of group velocity. The most amplified disturbance at any given frequency is oriented almost normal to the direction of the potential flow. The corresponding group velocity is directed almost along the direction of the potential flow. Dissert. Abstr.

N81-26071 California Univ., Davis.
NUMERICAL STUDY OF A TURBULENT JET IMPINGING ON A FLAT PLATE AND FLOWING INTO AN AXISYMMETRIC CAVITY Ph.D. Thesis
Ryoichi S. Amamo 1980 201 p
Avail: Univ. Microfilms Order No. 8111971

In the computations a hybrid finite difference method was used to solve the full Navier-Stokes equations for an incompressible submerged jet. A two equation turbulence model provides a turbulent kinetic energy equation and a turbulent energy

dissipation equation. For cells at the wall, kinetic energy is assumed to be parabolic in the viscous sublayer and linear in the fully turbulent region. All computed results are compared with experimental data reported in the literature. For the case of the jet impinging on a flat plate, computations were made of axial velocity, radial velocity, pressure, and skin friction. The computations were made for nozzle-to-plate distances ranging from 2 to 18 nozzle diameters. The fluid leaving the nozzle is assumed to have velocity profiles that either are uniform or 5.5 power profiles and have turbulence intensities ranging from 0.001 to 0.01, and nozzle Reynolds numbers ranging from 10,000 to 2,000,000. Dissert. Abstr.

N81-26072*# Stanford Univ., Calif.
STRAKE/DELTA WING INTERACTIONS AT HIGH ANGLES OF ATTACK
M. I. G. Bloor and R. A. Evans Apr. 1980 36 p refs
(Contract NCC2-55)
(NASA-CR-166183; SU-JIAA-TR-30) Avail: NTIS HC A03/MF A01 CSCL 01A

The method of vortex discretization is used to analyze the interaction of the vorticity generated by a strake, with the flow over a delta wing. The validity of the approach is first established by making comparisons with established methods for dealing with delta wings, after which compound delta planforms are discussed. An understanding of the favorable interference effects normally associated with this type of configuration is obtained and results are presented to quantify the expected lift increments resulting from the strake interaction. Author

N81-26073*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SYSTEM AND METHOD FOR REFURBISHING AND PROCESSING PARACHUTES Patent Application
Russell T. Crowell, inventor (to NASA) Filed 30 May 1980 19 p
(NASA-Case-KSC-11042-2; US-Patent-Appl-SN-154663) Avail: NTIS HC A02/MF A01 CSCL 01A

A system and method for refurbishing and processing parachutes is disclosed including an overhead monorail conveyor system on which the parachute is suspended for horizontal conveyance. The parachute is first suspended in a partially opened tented configuration wherein open inspection of the canopy is permitted to remove debris and inspect all areas. Following inspection, the parachute is transported by the monorail conveyor to a washing and drying station with the parachute canopy mounted on the conveyor in a systematic arrangement which permits water and air to pass through the ribbon-like materials of the canopy. Following drying, the chute is conveyed into an interior space where it is finally inspected and removed from the monorial conveyor for folding. The chute is once again mounted on the conveyor and conveyed to a packing area. NASA

N81-26074*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TAIR: A TRANSONIC AIRFOIL ANALYSIS COMPUTER CODE
F. Carroll Dougherty, Terry L. Holst, Karen L. Grundy (Informatics, Inc., Palo Alto, Calif.), and Scott D. Thomas (Informatics, Inc., Palo Alto, Calif.) May 1981 91 p refs
(NASA-TM-81296; A-8594) Avail: NTIS HC A05/MF A01 CSCL 01A

The operation of the TAIR (Transonic AIRfoil) computer code, which uses a fast, fully implicit algorithm to solve the conservative full-potential equation for transonic flow fields about arbitrary airfoils, is described on two levels of sophistication: simplified operation and detailed operation. The program organization and theory are elaborated to simplify modification of TAIR for new applications. Examples with input and output are given for a wide range of cases, including incompressible, subcritical compressible, and transonic calculations. A.R.H.

N81-26075*# Vought Corp., Dallas, Tex.
ADDITIONAL TESTING OF THE INLETS DESIGNED FOR A TANDEM FAN V/STOL NACELLE
Andres H. Ybarra Jun. 1981 148 p refs
(Contract NAS3-21468)
(NASA-CR-165310; TR-2-53020/IR-52726) Avail: NTIS HC A07/MF A01 CSCL 01A

The wind tunnel testing of a scale model of a tandem fan nacelle designed for a type (subsonic cruise) V/STOL aircraft configuration is discussed. The performance for the isolated front inlet and for the combined front and aft inlets is reported. Model variables include front and aft inlets with aft inlet variations of short and long aft inlet cowls, with a shaft simulator and diffuser vortex generators, cowl lip fillets, and nacelle strakes. Inlet pressure recovery, distortion, and inlet angle-to-attack separation limits were evaluated at tunnel velocity from 0 to 240 knots, angles-of-attack from -10 to +40 degrees and inlet flow rates corresponding to throat Mach number from 0.0 to 0.6. Combined nacelle pitch and yaw runs up to 30 deg. were also made. M.G.

N81-26076*# De Havilland Aircraft Co. of Canada Ltd., Downsview (Ontario).
PHASE 2 AND 3 WIND TUNNEL TESTS OF THE J-97 POWERED, EXTERNAL AUGMENTOR V/STOL MODEL
D. B. Garland Oct. 1980 148 p
(Contract NASw-2797)
(NASA-CR-152380; DHC-DND-80-1) Avail: NTIS HC A08/MF A01 CSCL 01A

Modifications were made to the model to improve longitudinal acceleration capability during transition from hovering to wing borne flight. A rearward deflection of the fuselage augmentor thrust vector is shown to be beneficial in this regard. Other augmentor modifications were tested, notably the removal of both endplates, which improved acceleration performance at the higher transition speeds. The model tests again demonstrated minimal interference of the fuselage augmentor on aerodynamic lift. A flapped canard surface also shows negligible influence on the performance of the wing and of the fuselage augmentor. T.M.

N81-26077*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
CALCULATION OF TWO-DIMENSIONAL INLET FLOW FIELDS BY AN IMPLICIT METHOD INCLUDING VISCOUS EFFECTS: PROGRAM DOCUMENTATION AND TEST CASE Final Report, 12 Sep. 1979 - 30 Nov. 1980
Sedat Biringen and Oden J. McMillan Jun. 1981 170 p refs
(Contract NAS1-15951)
(NASA-CR-3414; NEAR-TR-233) Avail: NTIS HC A08/MF A01 CSCL 01A

The source listing of a computer code for calculating the flow fields in a supersonic free stream is given. The application of this code to an inlet on an airbreathing missile is also presented. T.M.

N81-26078*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A PROCEDURE FOR DESIGNING FOREBODIES WITH CONSTRAINTS ON CROSS-SECTION SHAPE AND AXIAL AREA DISTRIBUTION
Raymond L. Barger Jul. 1981 14 p refs
(NASA-TP-1881; L-14516) Avail: NTIS HC A02/MF A01 CSCL 01A

A method is described for designing a forebody with cross sections which vary smoothly from an initial prescribed nose shape to a different prescribed base shape in such a way that the cross-section areas conform to a preassigned axial area distribution. It is shown that these conditions can be satisfied with a remaining degree of freedon, which can be used to accomplish a modest amount of geometric or pressure tailoring of the forebody. An example is provided which involves modifying the pressure distribution along a given meridian line of the forebody. Author

N81-26079# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
OPTIMIZATION OF MULTI-ELEMENT AIRFOILS Final Scientific Report, 1 May 1980 - 30 Apr. 1981
K. P. Misegades 30 Apr. 1981 74 p refs
(Grant AF-AFOSR-0177-80; AF Proj. 2301)
(AD-A099133; VKI-PR-1980-5; EOARD-TR-81-3) Avail: NTIS HC A04/MF A01 CSCL 20/4

A review of techniques aimed at maximizing C1/Cd and C1 for multi-element airfoils showed the need for more exhaustive testing of possible configurations of flap deflection, slot geometry

and airfoil angle of attack. For a typical 4-element airfoil, the number of possible configurations can easily be in the billions. A new technique, based on evolution strategy, has been developed for the problem of optimizing a multi-element airfoil with respect to its envelope of maximum C1/Cd versus C1. This technique was applied to an airfoil having a slotted leading edge flap and a double-slotted trailing edge flap using an existing computer program for 2D subsonic multi-element airfoils to provide values of aerodynamic coefficients. Although limitations of the program precluded the full determination of the envelope of C1/Cd vs C1 the problem of maximizing C1/Cd for a minimum C1 constraint was solved. GRA

N81-26080# Air Force Geophysics Lab., Hanscom AFB, Mass.
MODIFIED GAS VALVE FOR IMPROVED BALLOON DESCENT CONTROL Final Report
George F. Nolan, Larry D. Wrinkle, and Bernard D. Gildenberg 30 Oct. 1980 25 p refs
(AF Proj. 7659)
(AD-A099371; AFGL-TR-80-0333; AFGL-IP-294) Avail: NTIS HC A02/MF A01 CSCL 01/3

The ability to control balloon descent rates has been improved through use of a modified gas valve which has a range of openings. The descent rates obtained with this valve are more constant than those obtainable with the standard gas valve. Atmospheric temperature lapse rate and other thermal and aerodynamic influences are unquantifiable factors affecting balloon vertical motion, but are better compensated for when use is made of a variable opening gas valve. Even with this valve, slow descents on the order of 200 fpm or less will have oscillations with short periods of time when ascents and leveling off will occur. Author (GRA)

N81-26081# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.
THE INFLUENCE OF HEAT TRANSFER ON THE DRAG OF AIRFOILS Final Report, May 1979 - Sep. 1980
John D. Lee Wright-Patterson AFB, Ohio AFWAL Apr. 1981 47 p refs
(Contract F33615-79-C-3008; AF Proj. 2404)
(AD-A098822; AFWAL-TR-81-3030) Avail: NTIS HC A03/MF A01 CSCL 20/4

An experimental and theoretical study was performed to determine the effects of surface temperature on the drag of airfoils. Models of an aft-loaded profile and of a NACA 65A413 were tested with separate models providing pressure distributions and drag data from cooling or heating at a Mach number of 0.4 and Reynolds number of 2,500,000. Simultaneously an airfoil boundary layer analysis was performed using available theories and empirical correlations for laminar, transitional and turbulent boundary layers. Cooling was found to provide a lower drag and heating a higher value, as expected, for both profiles and the reduction by cooling was substantial for the aft-loaded profile at the condition tested. The measurements agreed well with the theoretical predictions which may then be used to evaluate the effects of both heat transfer and pressure gradients on airfoil transition and drag. Author (GRA)

N81-26082# Boeing Military Airplane Development, Seattle, Wash.
AERODYNAMIC ANALYSIS OF A FIGHTER AIRCRAFT WITH A HIGHER ORDER PANELING METHOD Final Report, Sep. 1978 - Jan. 1981
A. R. Dusto Wright-Patterson AFB, Ohio AFWAL Nov. 1980 627 p refs
(Contract F33615-77-C-3051; AF Proj. 2404)
(AD-A099404; AFWAL-TR-80-3115) Avail: NTIS HC A99/MF A01 CSCL 20/4

Results from analyses of steady and unsteady flows about several configurations involving the wing of the F-5 fighter airplane are presented. The analyses were performed using higher order panel methods and the configurations analyzed included the following: the clean wing (both in an unbounded and in a wind tunnel wall bounded atmosphere), the wing with an external missile store mounted at the wing tip, and the wing with an external missile store mounted on a pylon at the lower surface of the wing. The flow mach number ranged from 0.6 to 1.35 in steady flow and from 0.6 to 0.95 in unsteady flow. Each steady flow case is analyzed at three angles of attack (0.5 deg, 0.0 deg, 0.5 deg) while each unsteady flow case consisted of unsteady pitch oscillation about zero angle of attack. The reduced frequency of the oscillation was in the range from 0.2498 to 0.3955.GRA

N81-26039# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
A REVIEW OF METHODS FOR PREDICTING VISCOUS EFFECTS ON AEROFOILS AND WINGS AT TRANSONIC SPEEDS
R. C. Lock *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 32 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26040# Arizona Univ., Tucson.
INVISCID-VISCOUS INTERACTIONS IN THE NEARLY DIRECT DESIGN OF SHOCK-FREE SUPERCRITICAL AIRFOILS
H. E. Nebeck, A. R. Seebass, and H. Sobieczky (DFVLR, Goettingen, West Germany) *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 10 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26041# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Aerodynamische Versuchsanstalt.
THE COUPLING OF A SHOCK BOUNDARY LAYER INTERACTION MODULE WITH A VISCOUS-INVISCID COMPUTATION METHOD
E. Stanewsky, M. Nandanan, and G. R. Inger (Virginia Polytechnic Inst. and State Univ.) *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26042# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VISCOUS-INVISCID COUPLED CALCULATIONS IN UNSTEADY TWO-DIMENSIONAL INCOMPRESSIBLE AND TRANSONIC FLOW
A. Desopper and R. Grenon *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 21 p refs In FRENCH; ENGLISH summary (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26043# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
VISCOUS FLOW SIMULATION OF HIGH LIFT DEVICES AT SUBSONIC AND TRANSONIC SPEED
Stefan Leicher *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 15 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26044# Vereinigte Flugtechnische Werke G.m.b.H., Bremen (West Germany).
FLOW COMPUTATION AROUND MULTI-ELEMENT AIRFOILS IN VISCOUS TRANSONIC FLOW
H. Rosch and K. D. Klevenhusen *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 10 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26045# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
CALCULATIONS OF TRANSONIC FLOW OVER WING/BODY COMBINATIONS WITH AN ALLOWANCE FOR VISCOUS EFFECTS
M. C. P. Firmin *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 18 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26046# Boeing Military Airplane Development, Seattle, Wash.
PLANAR TRANSONIC AIRFOIL COMPUTATIONS WITH

VISCOUS INTERACTIONS
J. C. Wai and H. Yoshihara *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 9 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26047# Grumman Aerospace Corp., Bethpage, N.Y.
TURBULENT INTERACTIONS ON AIRFOILS AT TRANSONIC SPEEDS: RECENT DEVELOPMENTS
R. E. Melnik *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 34 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26048# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
COMPUTATION OF VISCOUS FLOWS OVER AIRFOILS, INCLUDING SEPARATION, WITH A COUPLING APPROACH
J. C. LeBalleur and M. Neron *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 15 p refs In FRENCH; ENGLISH summary (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26052# Flow Research, Inc., Kent, Wash.
A PHENOMENOLOGICAL MODEL FOR DISPLACEMENT THICKNESS EFFECTS OF TRANSONIC SHOCK WAVE-BOUNDARY LAYER INTERACTIONS
Wen-Huei Jou and Earl M. Murman *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26053*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
SIMPLE APPROXIMATIONS FOR THE ASYMPTOTIC DESCRIPTION OF THE INTERACTION BETWEEN A NORMAL SHOCK WAVE AND A TURBULENT BOUNDARY LAYER AT TRANSONIC SPEEDS
T. C. Adamson, Jr. and A. F. Messiter *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 p refs (For primary document see N81-26037 17-01)
(Grant NsG-1326)
Avail: NTIS HC A22/MF A01 CSCL 01A

N81-26055# Virginia Polytechnic Inst. and State Univ., Blacksburg.
SOME FEATURES OF A SHOCK-TURBULENT BOUNDARY LAYER INTERACTION THEORY IN TRANSONIC FLOW FIELDS
G. R. Inger *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 26 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26056# National Aerospace Lab., Amsterdam (Netherlands).
COMPUTATIONAL ASPECTS AND RESULTS OF LOW SPEED VISCOUS FLOW ABOUT MULTICOMPONENT AIRFOILS
B. Oskam *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26057# Douglas Aircraft Co., Inc., Long Beach, Calif. Aerodynamics Research.
SEPARATION AND REATTACHMENT NEAR THE LEADING EDGE OF A THIN AIRFOIL AT INCIDENCE
Tuncer Cebeci, Keith Stewartson (University Coll., London), and P. G. Williams (University Coll., London) *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 13 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26058# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Aerothermodynamique.
THE LAMINAR SEPARATION WITH TRANSITION BUBBLE [BULBE DE DECOLLEMENT LAMINAIRE AVEC TRANSITION: ESSAI DE PREVISION AVEC COUPLAGE LOCAL]
C. Gleyzes, J. Cousteix, and J. L. Bonnet *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 16 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26062# Royal Aircraft Establishment, Farnborough (England).
THE DEVELOPMENT AND APPLICATION OF A METHOD FOR CALCULATING THE VISCOUS FLOW ABOUT HIGH LIFT AEROFOILS
D. J. Butter (British Aerospace Aircraft Group, Stockport, England) and B. R. Williams *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 20 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26063*# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
A DIRECT INVERSE TECHNIQUE FOR LOW SPEED HIGH LIFT AIRFOIL FLOWFIELD ANALYSIS
Leland A. Carlson *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 10 p refs (For primary document see N81-26037 17-01)
(Grant NsG 1174)
Avail: NTIS HC A22/MF A01 CSCL 01A

N81-26064# Bari Univ. (Italy). 1st. di Machine.
A SECOND ORDER ACCURATE NUMERICAL METHOD FOR SUPERSONIC INTERACTING BOUNDARY LAYER FLOW PAST A COMPRESSION CORNER
Bernardo Fortunato *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26065# Centre d'Etudes Aerodynamiques et Thermiques, Poitiers (France).
COMPUTATION OF THE SHOCK-WAVE BOUNDARY LAYER INTERACTION WITH FLOW SEPARATION
P. Ardonceau, Th. Alziary (Poitiers Univ.), and D. Aymer *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 16 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26066# Bari Univ. (Italy). 1st di Machine.
TOWARD A SPLINE TECHNIQUE FOR THE HIGH REYNOLDS NUMBER INTERACTION (TRIPLE DECK) PROBLEM
M. Napolitano and G. Vacca *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 15 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26067# Royal Aircraft Establishment, Farnborough (England). Aerodynamic Dept
A THEORY OF THE SEPARATED FLOW PAST A SLENDER ELLIPTIC CONE AT INCIDENCE
S. P. Fiddes *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 p refs (For primary document see N81-26037 17-01) Avail: NTIS HC A22/MF A01

N81-26068*# Analytical Methods, Inc., Bellevue, Wash.
PREDICTION OF AERODYNAMIC CHARACTERISTICS FOR WINGS WITH EXTENSIVE SEPARATIONS
B. Maskew, B. M. Rao, and F. A. Dvorak *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 15 p refs (For primary document see N81-26037 17-01)
(Contracts NAS2-8788; N00014-78-C-0128; DAAG29-76-C-0019; DAAJ02-75-C-0036)
Avail: NTIS HC A22/MF A01 CSCL 01A

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N81-26083*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A LEARNING GUIDE FOR THE TERMINAL CONFIGURED VEHICLE ELECTRONIC HORIZONTAL SITUATION INDICATOR

Athena T. Markos Jun. 1981 36 p

(NASA-TM-83128) Avail: NTIS HC A03/MF A01 CSCL 01C

The electronic horizontal situation indicator (EHSI) course, one of four courses comprising the TCV crew-training curriculum, is designed to prepare pilots to effectively interpret and control the EHSI display and mode control panel on the TCV research simulator. Prerequisities for the course and a suggested learning approach are discussed. The course is available in manual form as well as a PLATO system. The manual contents and format are described as well as the learning activities, time-to-complete, and assessment system for student evaluation for the computer-based lessons. A.R.H.

N81-26084# National Transportation Safety Board, Washington, D. C. Bureau of Technology.

SAFETY REPORT: THE STATUS OF GENERAL AVIATION AIRCRAFT CRASHWORTHINESS

17 Dec. 1980 67 p refs

(PB81-160798; NTSB-SR-80-2) Avail: NTIS HC A04/MF A01 CSCL 01B

Improvements in the crashworthiness of automobiles during the past decade has been documented through a reduction of the fatality-to-injury ratios. Such improvement in general aviation aircraft crashworthiness has been sought by the National Transportation Safety Board, the Civil Aeronautics Board, and others for more than 35 years. Past accident investigations, regulatory developments, and crashworthiness research activities were reviewed, and the adequacy of current general aviation crashworthiness requirements was assessed. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N81-26085*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NAVIGATION SYSTEM AND METHOD Patent Application

J. W. Sennott (Howard Univ.) and R. E. Taylor Filed 22 May 1981 48 p

(Grant NGL-09-011-060)

(NASA-Case-GSC-12508-1; US-Patent-Appl-SN-266253) Avail: NTIS HC A03/MF A01 CSCL 17G

In a global positioning system (GPS), such as the NAVSTAR/GPS system, where the position coordinates of user terminals are obtained by processing multiple signals transmitted by a constellation of orbiting satellites, an acquisition-aiding signal generated by an Earth-based control station is relayed to user terminals via a geostationary satellite to simplify user equipment. The aiding signal is FSK modulated on a reference channel slightly offset from the standard GPS channel. The aiding signal identifies satellites in view having best geometry and includes Doppler prediction data as well as GPS satellite coordinates and identification data associated with user terminals within an area being served by the control station and relay satellite. NASA

N81-26086# Naval Ocean Systems Center, San Diego, Calif. Tactical Sensors and Electronic Warfare Div.

NAVTOLAND MICROWAVE SCANNING BEAM TESTS AT NOSC. THREE LANDING GUIDANCE SYSTEMS TESTED IN A SPECULAR MULTIPATH ENVIRONMENT Interim Report, Nov. 1980 - Jan. 1981

F. E. Morris Feb. 1981 123 p

(AD-A099298; NOSC/TR-646) Avail: NTIS HC A06/MF A01 CSCL 17/7

Results of testing Ku-band pulse-coded microwave scanning guidance system concepts are reported. Three different systems were tested under conditions of severe specular multipath. It is concluded that Ku-Band antennas with elevation and azimuth scanning beamwidths as wide as 4 and 6 deg, respectively, are adequate for shipboard landing guidance systems and that circular polarization and an elevation scan technique at low-angle-beam cutoff and mathematical beamfitting are effective solutions to multipath problems expected for a Navy shipboard system. Additionally, 1- and 2-microsec/deg coding was tested. No difference in accuracy was found. Author (GRA)

N81-26087# Electronic Systems Div., Hanscom AFB, Mass. Surveillance and Control Systems Directorate.

LORAN WARPAGE COEFFICIENTS GENERATION PROGRAM (WARP) Final Test Report

Michael A. Marchand, Jeri L. Kennedy, and Louise A. Kellett 23 Feb. 1981 75 p refs

(AD-A098988; ESD-TR-81-116-3) Avail: NTIS HC A04/MF A01 CSCL 17/7

This report details the final test results of computer program WARP. This program generates coefficients of a least-squares LORAN grid warpage model for use in the AN/ARN-101 Digital Avionics System. The coefficients enhance the capability of the AN/ARN-101 to accuratey convert from LORAN time differences to Latitude-Longitude pairs. Test results include input error checks, boundary jump analysis, altitude effects, and input data density. GRA

N81-26088# Federal Aviation Administration, Atlantic City, N.J. Technical Center.

DISCRETE ADDRESS BEACON SYSTEM (DABS) COMPUTER PERFORMANCE/TEST AND EVALUATION Interim Report, Dec. 1979 - Sep. 1980

Donald Fisher, Joseph Pino, and Daniel Fox Apr. 1981 58 p refs

(AD-A099326; FAA-CT-81-7; FAA-RD-81-12) Avail: NTIS HC A04/MF A01 CSCL 17/7

This document describes tests conducted on the Discrete Address Beacon System (DABS) engineering model sensor with the release 6.4 software package to measure the performance characteristics of the computer subsystem distributive architecture. Tests were conducted for various aircraft load conditions in three specific areas: system data bus contention, global memory address space utilization, and processor utilization. Both the methods of conducting these tests and the results obtained are described. It was concluded that system data bus contention is not a problem with the distributive architecture used. Release 6.4 of the DABS software uses less than 20,480 words of the available 24,576 global memory address space in 24 of the 29 active processors. This leads to the conclusion that no problem should be experienced in expanding the size of the processor local memories from 8,192 words to 12,288 words. Additionally, an expansion of the local memories to 16,384 words appears feasible with minor software changes. The expansion of local memory will enable each processor to perform more functions. This will reduce the total number of processors required and lead to less complexity and a smaller overall volume for DABS. Author (GRA)

N81-26089# Federal Aviation Administration, Atlantic City, N.J. Technical Center.

TEST AND EVALUATION OF REMOTE AREA PRECISION POSITIONING SYSTEM (RAPPS) Final Report, Aug. 1979 Mar. 1980

Matthew Naimo Mar. 1981 25 p refs

(AD-A099220; FAA-CT-80-52; FAA-RD-80-102) Avail: NTIS HC A02/MF A01 CSCL 17/7

Described is the test and evaluation of an airborne multilatera-

tion-distance measuring equipment (DME) position reference system to be used with a long range navigation (LORAN)-C data collection system. The system, Remote Area Precision Position System (RAPPS), was developed by Amex Systems, Incorporated under an Federal Aviation Administration (FAA)/ Systems Research and Development Service (SRDS) contract. In August 1979, the FAA Technical Center determined system accuracy using a Convair 580 aircraft as a test platform. Space position measurement of the aircraft was determined by the Center Nike-Hercules radar. When the range biases of the four DME ground stations were removed by postflight computation, flight test results from orbits about the Atlantic City DME beacon indicated a standard deviation error of 256 feet about a mean range error of -345 feet. Operational evaluation of the RAPPS airborne and ground subsystems was conducted during the winter in Vermont. The field evaluation determined that both the ground and airborne subsystems have significant design deficiencies of the hardware/software. Author (GRA)

N81-26090# Federal Aviation Administration, Atlantic City, N.J. Technical Center.

ANALYTICAL INVESTIGATION OF TIME CORRECTION IN ALPHA-BETA TRACKING FILTERS WITH APPLICATION TO EN ROUTE TRACKING Final Report, Mar. 1979 - Mar. 1980

Robert E. Lefferts Apr. 1981 47 p refs
(AD-A099218; FAA-CT-80-47) Avail: NTIS HC A03/MF A01 CSCL 17/1

In the analysis of the alpha-beta tracking filter, it is normally assumed that the tracking filter and data source operate in synchronism at a constant data rate. An analytical solution is obtained for the case in which the tracking filter and data source operate asynchronously, thus violating the standard assumptions. To compensate for the asynchronous operation of the filter, the technique of time correction is used to adjust the measured data point via the estimated velocity which approximates the synchronous operation of the filter and data source. The tracking filter performance in the steady-state case where time correction is used is better than that obtained from a fixed-parameter tracking filter in which the actual random time intervals between measurements are used as the temporal basis of filter operation. To ensure no degradation in system performance for purposes of air traffic control, a system timing accuracy on the order of 0.05 second is required to preserve the position measurement accuracy rather than the presently used technique which yields a timing accuracy on the order of 0.8 second. If the specified level of timing accuracy is not achieved, then it is postulated that significant errors will be introduced in the predicted position for maneuvering targets. System timing errors are presently the limiting factor in providing accurate position measurements for en route purposes and will partially nullify the data accuracy which will be available in the future.
Author (GRA)

N81-26091# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

PRECISION POSITIONING AND INERTIAL GUIDANCE SENSORS: TECHNOLOGY AND OPERATIONAL ASPECTS

Mar. 1981 370 p refs In ENGLISH; partly in FRENCH Symp. held at London, 14-17 Oct. 1980
(AGARD-CP-298; ISBN-92-835-0287-6) Avail: NTIS HC A16/MF A01

Inertial sensors and systems technology, development and status of positioning systems, and evaluation methods and results are discussed. Other topics include filtering and estimate, fault tolerance design and redundancy techniques, and systems requirements and applications. For individual titles, see N81-26092 through N81-26113.

N81-26092# Air Force Systems Command, Wright-Patterson AFB, Ohio.

INVESTIGATION OF A STRAPDOWN ATTITUDE AND HEADING REFERENCE SYSTEM UTILIZING RING LASER GYROS

George M. Siouris *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 14 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

The potential benefits of utilizing ring laser gyro technology in a strapdown attitude and heading reference system configuration for rotary and fixed wing aircraft are assessed. The ring laser gyro has demonstrated highly acceptable performance with the promise of even better results and greater design margins to enhance the low cost goals. System performance is evaluated using a strapdown covariance error analysis simulation. The covariance matrix represents the standard deviations of the errors in the system at any point in time of the trajectory or mission. Coupled with a transition matrix that propagates the covariance matrix forward along the route, the errors along the entire route can be computed. E.D.K.

N81-26093# British Aerospace Precision Products Group, Stevenage (England).

SMART INERTIAL MEASUREMENT UNITS AND THE COMPENSATION OF DYNAMICALLY TUNED GYROS FOR STRAPDOWN INERTIAL SYSTEMS

C. S. Edwards and R. J. Chaplin *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 19 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

The growth of low cost strapdown inertial guidance systems that has occurred in recent years is considerd. For the majority of current applications the only gyroscopes that are sufficiently mature for such systems are the rate integrating gyro and the dynamically tuned gyro. It is often thought that the error models of these two gyroscopes are very different and that it is more difficult to use the dynamically tuned gyroscope. It is shown that such impressions are misconceived and that both types of gyroscope are being offered in packages complete with digital compensation of the error terms. E.D.K.

N81-26094# Honeywell, Inc., St. Petersburg, Fla. Avionics Div.

ESG INERTIAL TECHNOLOGY: AN APPROACH TO SELF-CONTAINED PRECISION NAVIGATION AND POSITIONING ON AND OVER THE BATTLEFIELD

Michael J. Hadfield *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 18 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

Special topics such as the hybrid operation of high precision electrically suspended gyroscopes (ESG) systems are described and discussed. The relatively low reliance of ESG inertial systems on other navigation aids is considered. The importance of this feature in the adverse electromagnetic radiation environment of the battlefield is evaluated. The importance of effective Kalman filtering to hybrid system operation is reviewed. The hardware developments which led to the emergence of ESG inertial technology are summarized and interrelated with software developments. Critical parameters such as accelerometer and gyro stability in the battlefield environment are addressed and supporting test data provided for the error budget values. Other hardwares, such as the fault tolerance benefits of design centering as well as built in fault detection and isolation are described in terms of the SPN/GEANS and GEO-SPIN equipments. E.D.K.

N81-26095# Standard Elektrik Lorenz A.G., Stuttgart (West Germany).

THE POTENTIAL OF A MULTIFUNCTION INFORMATION DISTRIBUTION SYSTEM (MIDS) FOR POSITION LOCATION

G. Hoefgen *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 13 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

The multifunction information distribution system (MIDS) offers a great potential for position location and navigation. The position location is accomplished by multiranging based on time of arrival measurements. Besides this preferred passive mode an active method providing range and time measurements most accurately and independently from each other is feasible. The achievable accuracy depends on the operational and physical environment and on the performance of the equipment used. For the stationary case, which is characterized by fixed or very slowly moving participants, the main parameters determining

accuracy are source time and position qualities, propagation time measurement accuracy, short term clock stability, geometric dilution of precision, and propagation anomalies. In the dynamic case characterized by fast moving users the accuracy is further degraded by the user dynamics, the P-message rate, the filter performance, and the dead reckoner performance. E.D.K.

N81-26096# ITT Avionics, Nutley, N.J.
JTIDS DISTRIBUTED TDMA (DTDMA) TERMINAL DEVELOPMENT RESULTS WITH EMPHASIS ON RELATIVE NAVIGATION PERFORMANCE
J. Rubin and S. Welt *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 14 p refs (For primary document see N81-26091 17-04)
(Contract N66269-76-C-0105)
Avail: NTIS HC A16/MF A01

Extensive testing of the command and tactical terminals were performed utilizing the joint tactical information distribution system environment simulator (JES) to simulate highly dynamic and diverse RF environments. System performance limits were obtained with barrage and optimum jamming for active and passive net entry as well as for each communication function individually and various mixes of com/nav functions. Multinet, multifunction tests were performed utilizing time division multiple access (TDMA), distributed TDMA, and TACAN waveforms simultaneously. Communication and navigation system function design, integration, dynamic laboratory verification, and transition to field test tasks were aided by using the dynamic real time simulation and evaluation capabilities of the JES. The computer controlled JES furnished an effective method of bridging the gap and provided a smooth transition between system integration and field test phase of the program. E.D.K.

N81-26097# Singer-Kearfott, Wayne, N. J.
JTIDS DUAL GRID NAVIGATION USING TIME SYNCHRONIZED DATA LINKS
Robert C. Stow and Joel D. Reiss *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 17 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

A comprehensive survey is presented of the fundamental theory, principal design considerations, and expected operational performance capabilities of relative navigation utilizing the JTIDS data link. The design of the relative navigation estimation algorithm is presented beginning with a description of the basic methodology of dual grid hybrid navigation, with special emphasis on modelling considerations within the relative navigation Kalman filter and the observation screening algorithm. These considerations include requirements for global navigation, communities composed of mixed types of dead reckoning units, and efficient usage of available data provided the JTIDS data link. Specific requirements for integration of the basic software design in a robust configuration are discussed and expected performance levels within various community structures are presented. The application of this capability to operational problems in targetting and weapon delivery are emphasized. E.D.K.

N81-26098# Thomson-CSF, Bagneux (France).
SINTAC AND ITS POSITIONING PERFORMANCES [LE SINTAC ET SES PERFORMANCES EN LOCALISATION]
Cj. Milosevic, J. C. Charavit, and M. Ronsin *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 38 p refs In FRENCH (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

A short review of the SINTAC program is presented and the information processing when the terminal is used in the navigation mode is described. The receiver of the SINTAC terminal provides a series of distance information. It is shown that the major hardware errors are related with the terminal master oscillator and the interval between synchronization. The navigation processor includes a Kalman filter which smoothes these data and reduces them using the craft bearing and the air data. Using the hardware limitation and the Kalman algorithm, the results of the simulation program are given. The navigation errors are in accordance with the forecasts. They are within 20 meters when the distance measurements occur with an average of 1 second. E.D.K.

N81-26099# Air Force Systems Command, Los Angeles, Calif.
NAVSTAR GPS PROGRAMME REVIEW
Hugh Coriat *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 10 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

The origins of the Navstar Global Positioning System are traced. The activities and results of the first formal phase of the program which set out to validate the GPS concept are reviewed. The current activities which are focused on the full scale engineering development of the system are disucussed, as well as the system's operational deployment. E.D.K.

N81-26100# Air Force Space Div., Los Angeles, Calif.
NAVSTAR FIELD TEST RESULTS
Robert L. Peterson *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 7 p (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

The most significant user equipment tests conducted during the concept validation phase of the Navstar Global Positioning System are described. These tests demonstrated that a 10 to 20 meter accuracy is achievable and a very precise navigation capability has a wide range of military applications. E.D.K.

N81-26101# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).
ESTIMATION OF STRAPDOWN SENSOR PARAMETERS FOR INERTIAL SYSTEM ERROR-COMPENSATION
D. K. Joos and U. K. Krogmann *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 25 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

Laboratory test procedures to determine static and dynamic parameters of the gyro and accelerometer measurement model are determined. It is shown that a proper rate test and a multiposition test with respect to Earth rate and gravity vector are well suited to ascertain static parameters with sufficient accuracy. Optimal parameter values are retrieved from measured test-data applying regression analysis techniques. It is further shown how uncertainities in parameter estimates can be determined from actual measurement residues. The verification of major dynamic performance parameters of interest (i.e., anisoinertia torque, angular acceleration term) by appropriate test procedures utilizing a 3-axes testtable is illustrated. Applicability and feasibility of the proposed test procedures is demonstrated utilizing the modular strapdown system (MSS). Test configuration and sequence as well as processing of test data including collection and reduction are described. Significant MSS error parameters are extracted and evaluated applying iterative linear regression techniques. The corresponding software-structure is also described. The results obtained confirm the usefullness of the developed test-procedures and software for calibrating a strapdown system with sufficient accuracy. It is further indicated that the software package exceeds its pure calibration function. R.C.T.

N81-26102# Centre d'Essais en Vol, Bretigny-sur-Orge (France).
EVALUATION OF A HYBRID NAVIGATION SYSTEM WITH LASER GYROSCOPES: SEXTAN [EVALUATION D'UN SYSTEME DE NAVIGATION HYBRIDE A GYROLASERS SEXTAN]
D. Regnault, J. Leclerc (Crouzet Aerospace and Systems), B. deSalaberry (Societe Francais d'Equipment pour la Navigation Aerienne, Velizy Villacoublay, France), and J. P. Pradoux (Societe Francais d'Equipment pour la Navigation Aerienne, Boulogne, France) *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 20 p In FRENCH (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

The program SEXTAN was designed for low flying military helicopters. The design considerations included cost reduction as a major factor in order to comply to the European economic markets and military needs. Major components of the system include: three laser gyroscopes, three accelerometers, an on-board computer, Doppler radar, and a control terminal that utilizes computer graphics for visual presentation of flight control data. Transl. by T.M.

N81-26103# Naval Air Development Center, Warminster, Pa. Communication Navigation Technology Directorate.
FLIGHT TEST RESULTS OF AN ADVANCED DEVELOPMENT MODEL RING LASER GYRO NAVIGATOR (RLGN)
Kenton L. Bachman *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 9 p ref (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

The requirements leading to the formulation of an advanced development program for the RLGN are addressed. The functional description of the RLGN including key hardware and software design features are described. Particular emphasis is given to a discussion of the flight test program in an A-7E and P-3C aircraft, and the resultant navigation and reliability performance. Effects of high latitude on system alignment and navigation is also discussed. The proposed follow on full scale development of a second generation carrier aircraft inertial navigation system (CAINS-II) applicable to all Navy carrier aircraft is given. R.C.T.

N81-26104# Naval Air Development Center, Warminster, Pa. Communication and Navigation Technology Directorate.
JTIDS RELATIVE NAVIGATION TEST AND EVALUATION
Lawrence Newman and Patrick J. Finnegan *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 9 p (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

An extensive test program was conducted to measure the performance of the advanced development model of the joint tactical information distribution system. The test program, flight scenarios, data analysis and general results of this effort are described. R.C.T.

N81-26105# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
INTEGRATED NAVIGATION SYSTEMS BASED ON MULTIPLE DME
Ulrich Brokof and Karlheinz Hurrass *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 10 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

Two integrated navigation systems are described which consist of a self contained dead reckoning system which is constantly aided by distance measurements down to different distance measuring equipment (DME) ground stations. The first dead reckoning system is based on the true air speed as well as the heading of the aircraft. The second one is an inertial navigation system. The integration of the dead reckoning systems and the DME system was carried out by means of a Kalman filter. The DME interrogator was constantly switched over to frequencies of five different ground stations. Both integrated systems were tested during test flights made by the jet aircraft HFB 320. A tracking radar was used for determining reference trajectories in order to check the self diagnosis of the Kalman filter. A comparison between the two systems shows that extremely high navigation accuracies can be obtained, too, by the dead reckoning system which is less expensive. R.C.T.

N81-26106# Canadian Marconi Co., Montreal (Quebec).
DYNAMIC PERFORMANCE ANALYSIS OF NAVSTAR/GPS NAVIGATION FILTERS
Michael John Dyment and David Feseng Lian (Defence Research Establishment, Ottawa) *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 19 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

Real time performance capabilities of a Navstar Global Positioning System Receiver equipped with a Kalman navigation filter are addressed. The results presented are derived from detailed simulation. The root-sum-square position and velocity error performance is examined in light of required processing power. R.C.T.

N81-26107# Naval Air Development Center, Warminster, Pa.
RAPID ALIGNMENT OF AIRCRAFT STRAPDOWN INERTIAL NAVIGATION SYSTEMS USING NAVSTAR GLOBAL POSITIONING SYSTEM (GPS)
Robert W. Tafel, Jr. and David Krasnjanski *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 20 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

The use of the GPS navigation satellite system as a reference for the in air alignment of a strapdown inertial navigation system (INS) was investigated. A Kalman filter covariance simulation program was used to determine the optimal alignment performance which can be achieved with a hybrid INS/GPS configuration. The sensitivity of in air alignment to reset interval and choice of observable was examined. The impact of various flight profiles upon the effectiveness of the alignment mechanism was evaluated. The alignment sensitivities determined in the optimal study were then used to develop a suboptimal alignment filter suitable for mechanization in an airborne computer. The trade off between filter size and alignment speed and accuracy was determined. The recommended filter was compared to the optimal filter over a range of alignment conditions in order to demonstrate its effectiveness. R.C.T.

N81-26108# Naval Air Development Center, Warminster, Pa.
NEW NAVY PROGRAMS FOR DEVELOPMENT OF INTEGRATED INERTIAL SENSORS
Charles R. Abrams and Robert J. Skoyles *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 14 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

Concepts in sensor redundancy and subsystem integration are described for navigation/flight control functions and other using subsystems. The major emphasis is on a reduction in the number of required sensors, by the use of skewed configurations and functional integration. Substantial improvements in reliability and maintainability are anticipated from both the reduction in sensor complement and the introduction of ring laser gyros. Survivabilty is enhanced by the dispersion of redundant units. The data management software for skewed rate sensors and accelerometers that were developed, validated in the laboratory, and verified in flight tests are discussed. Status of planned system hardware, software, and flight testing for an advanced development model of an integrated inertial sensor assembly to supply inertial data for flight control, weapon delivery and navigation are also presented. R.C.T.

N81-26109*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass. Control and Flight Dynamics Div.
F-8 DIGITAL FLY-BY-WIRE AIRCRAFT ANALYTIC REDUNDANCY MANAGEMENT FLIGHT TEST EXPERIENCE
James C. Deckert *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 11 p refs (For primary document see N81-26091 17-04)
(Contract NAS4-2675)
Avail: NTIS HC A16/MF A01 CSCL 17G

The formulation and flight test results of an algorithm to detect and isolate the first failure of any one of twelve duplex control sensors being monitored are described. The technique uses like sensor output differences for fault detection while relying upon analytic redundancy relationships among unlike quantities to isolate the faulty sensor. The fault isolation logic utilizes the modified sequential probability ratio test, which explicitly accommodates the inevitable irreducible low frequency errors present in the analytic redundancy residuals. In addition, the algorithm uses sensor output selftest, which takes advantage of the duplex sensor structure by immediately removing a highly erratic sensor from control calculations and analytic redundancy relationships while awaiting a definitive fault isolation decision via analytic redundancy. R.C.T.

N81-26110# Lowell Univ., Mass.
ENHANCING POSITION RELIABILITY BY FULLY INTEGRATING JTIDS AND GPS
H. James Rome, Robert A. Reilly (ITT Avionics, Nutley, N.J.), and Charles R. Ward (ITT Avionics, Nutley, N.J.) *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 16 p refs (For primary document see N81-26091 17-04)
Avail: NTIS HC A16/MF A01

The key functional design features of a fully integrated JTIDS/GPS receiver are described. It is shown that by fully integrating the signal processing of both systems, and by

appropriate source selection algorithms, the control and slewing of the GPS tracking loops make it possible to dramatically enhance the positional reliability of the two systems. Functional block diagrams of the integrated design approach are described. In addition, the rationale for key elements of the design approach is outlined. A performance estimate is made showing the increase in the tolerable jammer to signal ratio made possible through integrating the systems. R.C.T.

N81-26111# Magnavox Co., Torrance, Calif. Advanced Products and Systems.

NAVSTAR GPS RECEIVER FOR SATELLITE APPLICATIONS

R. Thorensen, K. M. Joseph, J. J. Winterhalter, and J. R. Champion (APL, Laurel, Md.) *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 21 p refs (For primary document see N81-26091 17-04)

Avail: NTIS HC A16/MF A01

A GPS navigation receiver/processor and ancillary units which combined constitute a spaceborne GPS Navigator (GPSPAC) are described. This navigator is intended for use on low altitude satellite host vehicles, i.e., LANDSAT D. The GPSPAC provides highly accurate three dimensional position and velocity of the host vehicle together with precision time determination using signals from NAVSTAR/GPS constellation of navigation development satellites. The GPSPAC system architecture and design are described, functional and operational characteristics discussed as well as principal hardware, software and navigation features. A description of test support equipment, test methods and test results is presented. R.C.T.

N81-26112# Litton Systems, Inc., Woodland Hills, Calif. Guidance and Control Systems Div.

JTIDS STRAPDOWN INERTIAL MIDCOURSE GUIDANCE PERFORMANCE ANALYSIS

Sam C. Bose *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 13 p refs (For primary document see N81-26091 17-04)

Avail: NTIS HC A16/MF A01

Midcourse guidance performance of ship launched missiles against over the horizon airborne targets is investigated. The strapdown inertial guidance system of the missile was augmented by JTIDS passive ranging from two airborne early warning aircraft situated between the launching ship and the target. The purpose of midcourse guidance was to place the missile in an acquisition basket sufficiently small to permit target sighting by the seeker within the constraints of its field of view and acquisition range. The terminal seeker pointing angle errors of the missile to target line of sight was selected as the performance index. Seeker pointing angle errors at acquisition time were functions of missile navigation position and attitude errors. Missile navigation errors were obtained as a function of different inertial instrument errors and JTIDS errors. Different shipboard alignment techniques and inertial instrument error budgets were included in the performance analysis. A typical relative range updating scheme in accordance with the timing structure of JTIDS was used in a Kalman filter to augment the strapdown inertial navigation system of the missile. The major error sources affecting midcourse guidance were identified and the results obtained give seeker pointing angle errors as a function of shipboard alignment technique, quality of the inertial instruments, seeker acquisition range and JTIDS relative range updating. R.C.T.

N81-26113# Systems Control, Inc., Palo Alto, Calif.

INTEGRATION OF POSITIONING AND NAVIGATION INTO THE C-(3)I STRUCTURE

R. Denaro, F. Karkalik, and S. W. Gilbert (Office of the Secretary of Defense) *In* AGARD Precision Positioning and Inertial Guidance Sensors Mar. 1981 11 p refs (For primary document see N81-26091 17-04)

Avail: NTIS HC A16/MF A01

The role of positioning and navigation information in the C(3)I structure is defined. A candidate methodology to assure its integration in C(3)I design and mission analysis is presented. All levels of conflict, from strategic to tactical are considered, since positioning and navigation play an important role at any level. An example mission is described in terms of the potential of deep pos/nav integration for benefiting the C(3)I process. R.C.T.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-26114* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

COOLING SYSTEM FOR HIGH SPEED AIRCRAFT Patent

Pierce L. Lawing (McDonnel Aircraft Co., St Louis) and LaVerne L. Pagel, inventors (to NASA) (McDonnell Aircraft Co., St. Louis) Issued 16 Jun. 1981 8 p Filed 31 Jan. 1979 Supersedes N79-24980 (17 - 16, p 2073) Sponsored by NASA

(NASA-Case-LAR-12406-1; US-Patent-4,273,304; US-Patent-Appl-SN-008210; US-Patent-Class-244-117A; US-Patent-Class-60-730; US-Patent-Class-60-267; US-Patent-Class-60-259; US-Patent-Class-62-DIG.5; US-Patent-Class-165-104.14; US-Patent-Class-244-163) Avail: US Patent and Trademark Office CSCL 01C

The system eliminates the necessity of shielding an aircraft airframe constructed of material such as aluminum. Cooling is accomplished by passing a coolant through the aircraft airframe, the coolant acting as a carrier to remove heat from the airframe. The coolant is circulated through a heat pump and a heat exchanger which together extract essentially all of the added heat from the coolant. The heat is transferred to the aircraft fuel system via the heat exchanger and the heat pump. The heat extracted from the coolant is utilized to power the heat pump. The heat pump has associated therewith power turbine mechanism which is also driven by the extracted heat. The power turbines are utilized to drive various aircraft subsystems, the compressor of the heat pump, and provide engine cooling.

Official Gazette of the U.S. Patent and Trademark Office

N81-26115 Texas Univ. at Arlington.

THE CRITICALITY OF ENGINE EXHAUST SIMULATIONS ON VSTOL MODEL-MEASURED GROUND EFFECTS Ph.D. Thesis

James Royce Lummus 1980 219 p

Avail: Univ. Microfilms Order No. 8111703

The effects of varying the nozzle exit turbulence, total pressure distributions, and nozzle pressure ratio on the net and component ground-induced forces for two-, three-, and four-nozzle configurations with large blocking surfaces (as well as a smaller, cruciform two-nozzle blocking surface more characteristic of a real aircraft planform) were studied. Nozzle exit turbulent intensities and pressure distributions were determined by exit surveys with a Kulite subminiature pressure transducer and a total pressure probe. Screens of varying grid size and plates with varying hole patterns were used to achieve variations in turbulent intensity and pressure distributions (respectively) that are characteristic of real aircraft turbojet and turbofan engines at representative nozzle pressure ratios ranging from 1j5 to 2.4. It was determined that turbulence can be changed by increasing the screen grid size, varying the pressure distribution, or decreasing the nozzle pressure ratio.

Dissert. Abstr.

N81-26116*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

FLAP-LAG-TORSIONAL DYNAMIC MODELLING OF ROTOR BLADES IN HOVER AND IN FORWARD FLIGHT, INCLUDING THE EFFECT OF CUBIC NONLINEARITIES

M. R. M. CrespoDaSilva Jul. 1981 73 p refs (Grant NAG2-38)

(NASA-CR-166194; ASD-81-6-1) Avail: NTIS HC A04/MF A01 CSCL 01C

The differential equations of motion, and boundary conditions, describing the flap-lead/lag-torsional motion of a flexible rotor blade with a precone angle and a variable pitch angle, which incorporates a pretwist, are derived via Hamilton's principle. The meaning of inextensionality is discussed. The equations are

reduced to a set of three integro partial differential equations by elimination of the extension variable. The generalized aerodynamic forces are modelled using Greenberg's extension of Theodorsen's strip theory. The equations of motion are systematically expanded into polynomial nonlinearities with the objective of retaining all terms up to third degree. The blade is modeled as a long, slender, of isotropic Hookean materials. Offsets from the blade's elastic axis through its shear center and the axes for the mass, area and aerodynamic centers, radial nonuniformaties of the blade's stiffnesses and cross section properties are considered and the effect of warp of the cross section is included in the formulation. E.A.K.

N81-26117*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

FLAG-LAG-TORSIONAL DYNAMICS OF EXTENSIONAL AND INEXTENSIONAL ROTOR BLADES IN HOVER AND IN FORWARD FLIGHT Semiannual Progress Report, Jan. - Jun. 1981

M. B. M. CrespoDaSilva Jun. 1981 3 p refs
(Grant NAG2-38)
(NASA-CR-164475) Avail: NTIS HC A02/MF A01 CSCL 01C

The formulation of differential equations of motion for both extensional and inextensional rotor blades, and the effect of cubic nonlinearities was examined. The developed differential equations are reduced to a set of three integro partial differential equations for a hingeless blade by eliminating the extension variable. Aerodynamic forces are modelled using Greenberg's extension of Theodorsen's strip theory. Equations of motion are expanded into polynomial nonlinearities to evaluate the motion of the system. E.A.K.

N81-26118*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

FLIGHT TEST RESULTS OF AN ACTIVE FLUTTER SUPPRESSION SYSTEM INSTALLED ON A REMOTELY PILOTED RESEARCH VEHICLE

John W. Edwards May 1981 14 p refs Presented at the AIAA Struct. Dyn. Spec. Meeting, Atlanta, 9-10 Apr. 1981
(NASA-TM-83132) HC A02/MF A01 CSCL 01C

Flight flutter test results of the first aeroelastic research wing of NASA's drones for aerodynamic and structural testing (DAST) program are presented. The implementation of the flutter suppression system and the flight test operation are described. The conduct of the flutter testing and the near-real time damping estimation algorithm are also described in detail. Flight data was obtained at Mach numbers up to 0.91 and was of high quality. Response to fast frequency sweep excitation provided reliable damping estimates and the open-loop flutter boundary was well defined. Evidence of angle-of-attack effects upon damping at high transonic Mach numbers is also presented. While the flutter suppression system provided augmented damping at speeds below the flutter boundary, an error in the implementation of the system gain caused the system to be less stable than predicted and the vehicle encountered system-on flutter on the third flight. Author

N81-26119# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

VALIDATION STUDY OF THE V/STOL AERODYNAMICS AND STABILITY AND CONTROL MANUAL Final Report

M. M. Walters 31 Mar. 1981 30 p refs
(WF41400000)
(AD-A099236; NADC-81051-60) Avail: NTIS HC A03/MF A01 CSCL 20/4

The methods contained in the V/STOL Aerodynamics and Stability and Control Manual for the prediction of propulsion induced aerodynamics of V/STOL aircraft in the hover and transition flight regimes were validated against four different V/STOL aircraft configurations. Manual prediction of the induced lift and pitching moment resulted in good correlation with test data for all configurations. Author (GRA)

N81-26120*# Hughes Helicopters, Culver City, Calif.

PRELIMINARY DESIGN OF A TIP-JET-DRIVEN HEAVY LIFT HELICOPTER INCORPORATING CIRCULATION CONTROL

R. E. Head Bethesda, Md. DTNSRDC Mar. 1981 43 p refs
(Contract N00167-80-C-0066; WF41421091)
(AD-A099192; HH-80-466; DTNSRDC/ASED-81/07) Avail: NTIS HC A03/MF A01 CSCL 01/3

This report describes a preliminary design study for a Very Heavy Lift Helicopter (VHLH) that is powered by jets at the blade tips and is controlled by circulation control applied to the main rotor blades. The main thrust of the program was to integrate a tip-jet-powered helicopter design computer program developed by Hughes Helicopters, Inc. (HHI) with circulation control data generated by the David Taylor Naval Ship Research and Development Center (DTNSRDC). This work combined the computer program integration work with an air vehicle preliminary design study to size the helicopter and describe its features. The result of this study is the sizing of a four-engined helicopter with a 185 foot diameter, two-bladed main rotor that is designed to carry the XM-1 Main Battle Tank 100 nautical miles in a ship-to-shore Marine Corps assault mission. GRA

N81-26121# Textron Bell Helicopter, Fort Worth, Tex.

FLIGHT TEST EVALUATION OF A NONLINEAR HUB SPRING ON A UH-1H HELICOPTER Final Report

P. J. Hollifield, L. W. Dooley, J. R. VanGaasbeek, J. D. Honaker, and J. Carr Apr. 1981 159 p refs
(Contract DAAJ02-77-C-0064; DA Proj. 1L2-62209-A-H-76)
(AD-A098794; AVRADCOM-TR-80-D-27) Avail: NTIS HC A08/MF A01 CSCL 01/3

A nonlinear hub spring design and results of the subsequent flight testing as a concept to provide increased mast bumping safety margin for the UH-1H helicopter are presented. Although there is a need for additional testing, the hub spring is shown to provide an increased margin of safety by reducing main rotor flapping in all conditions tested. As a part of this effort, a hybrid computer program was verified as able to predict mast loads due to flapping stop contact. Using this program a parametric study of mast loads as a function of rotor flapping was performed in order to develop a design criteria to ensure that mast loads can be sustained during in-flight flapping stop contact. In addition, a comparison of the main rotor flapping predicted by the hybrid computer and the digital computer C81 program using elastic blades is shown. Also, an evaluation of U. S. Army helicopter tactics to determine which NOE maneuvers are susceptible to high main rotor flapping is presented. Author (GRA)

N81-26122# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.

AN INTRODUCTION TO THE AERODYNAMICS OF SPOILERS

S. R. Siddalingappa and G. J. Hancock Aug. 1980 35 p refs
(PB81-166183; QMC/EP-1034) Avail: NTIS HC A03/MF A01 CSCL 01C

Some of the main features discussed include: two dimensional spoiler/airfoil combinations with and without flaps; three dimensional spoiler/wing combinations with comparison of aileron/wing combinations over a range of incidence and Mach as reflected in the lift, rolling moment, yawing moment and pitching moment characteristics. No attempt is made to compare the full set of data available in the literature; to some extent configurations tested are so diverse and test conditions unknown that comparisons are not realistic. A bibliography of the literature is also included. GRA

N81-26123# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.

APPLICATION OF VORTEX LATTICE METHODS TO CALCULATE Lv (ROLLING MOMENT DUE TO SIDESLIP)

M. A. Javed and G. J. Hancock Aug. 1980 31 p refs
(PB81-166167; QMC/EP-1038) Avail: NTIS HC A03/MF A01

Four differing models of vortex lattice patterns are formulated to predict the loads on a finite wing in sideslip. It was demonstrated that to obtain acceptable results for the rolling moment, it is necessary to incorporate some representation of the zero loading condition on the downstream wing tip although the detailed modeling in this region does not appear to be important. Theoretical results for the spanwise loading distribution derived from recommended vortex lattice models compare closely with some experimental data. GRA

N81-26124# Queen Mary Coll., London (England). Dept. of Aeronautical Engineering.
SOME QUALITATIVE EXPERIMENTS ON THE LOCAL FLOW ABOUT SPOILERS IN UNSTEADY MOTION AT LOW SPEEDS
S. R. Siddalingappa and G. J. Hancock Aug. 1980 50 p refs (PB81-166159; QMC/EP-1035) Avail: NTIS HC A03/MF A01 CSCL 01C

The local flow was examined when there is reattachment of the flow downstream of the spoiler. All unsteady measurements pose practical difficulties and uncertainties; it is thought that the qualitative trends indicated are reasonable although the quantitative numbers should be treated with caution. GRA

N81-26125# General Accounting Office, Washington, D. C.
OPERATIONAL AND SUPPORT COSTS OF THE NAVY'S F/A-18 CAN BE SUBSTANTIALLY REDUCED Report to the Congress
6 Jun. 1980 69 p ref
(PB81-160814; LCD-80-65) Avail: NTIS HC A04/MF A01 CSCL 01C

Cost reduction methods include: the use of multiport avionics test equipment; the consolidation of avionics repair facilities; the buying of initial spares concurrently with aircraft installed units; and a more effective use of pilot simulators. The consolidation of F/A-18 squadrons into larger size units is discussed. A reliability centered maintenance concept is presented that would determine the need for depot maintenance and pipeline aircraft. T.M.

N81-26126# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
HELICOPTER FATIGUE LIFE ASSESSMENT
Mar. 1981 261 p refs Partly in ENGLISH and FRENCH Proc. of 51st meeting held in Axi-en-Provence, France, 14-19 Sep. 1980
(AGARD-CP-297; ISBN-92-835-0289-2) Avail: NTIS HC A12/MF A01

The substantiation of the fatigue life of civil and military helicopters is considered with emphasis on comparisons with operational experience, the development of new technologies and the advent of new concepts. Topics covered include; current procedures, damage tolerance and fail safe concepts; service experience with existing procedures; testing techniques and methodology; constant amplitude spectrum loading. For individual titles, see N81-26127 through N81-26143.

N81-26127# National Aerospace Lab., Emmeloord (Netherlands).
STATE OF THE ART AND STATISTICAL ASPECTS OF HELICOPTER FATIGUE SUBSTANTIATION PROCEDURES
R. Noback *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 22 p refs (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

The recipe that is used to calculate safe fatigue life for helicopter components is described. Basic ingredients are flight loadspectrum, derived from measured flightloads and mission profile; a reduced S-N curve, based on statistically treated coupon and specimen test results; and a damage hypothesis. These ingredients are generally used, but many different ways of handling, especially statistically, exist and these may lead to a great variety of calculated safe fatigue lives. An example is used to illustrate the influence of various ways of handling on the end result. An attempt is made to bring together alternative statistical opinions. Author

N81-26128# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
FATIGUE ASSESSMENT OF UK MILITARY AEROPLANES
J. L. M. Forsyth *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 6 p (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

Fatigue assessment procedures used in the United Kingdom at all stages from the initial specification of the mission profile to the monitoring of Service use of military aircraft are described. The present thinking on fatigue assessment procedures for fiber reinforced plastic and damage tolerant structures as well as the latest work on loads measurement and in service monitoring is indicated. A.R.H.

N81-26129# Army Aviation Research and Development Command, St. Louis, Mo. Structures and Aeromechanics Div.
SYNOPSIS OF SPECIALISTS' MEETING ON HELICOPTER FATIGUE METHODOLOGY
Dean C. Borgman and Daniel P. Schrage *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 10 p refs Also presented at the Am. Helicopter Soc. Spec. Meeting, St. Louis, 25-27 Mar. 1980 (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

The principal results from the American Helicopter Society (AHS) Specialists' Meeting on Helicopter Fatigue Methodology held in St. Louis, Mo., on March 25-27, 1980 are summarized. The four essential elements of fagigue methodology usage spectrum, flight loadings, component testing, and life calculations were considered as well as the feasibility of standardization of helicopter fatigue methodology. The manufacturers' fatigue methodology based on a calculated fatigue life of a hypothetical helicopter component was presented. A.R.H.

N81-26130# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
APPLICATION OF DAMAGE TOLERANCE CONCEPTS FOR THE HELICOPTERS
M. V. Tapavicza and F. Och *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 8 p refs (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

The more and more pronounced tendency of modern helicopters towards higher efficiency and reliability requires materials and structural designs possessing high strength and good damage tolerance behavior. The damage tolerance methodology used for helicopters of the BO 105 family as well as for the BK 117 is outlined. One example of each type of damage tolerant design, realized in or developed for MBB helicopters is discussed and the design criteria for the other vital components are summarized. It is shown that only a few vital components are designed according to the safe life philosophy. A.R.H.

N81-26131# Societe Nationale Industrielle Aerospatiale Marignane (France.) Div. Helicopters.
FATIGUE ANALYSIS OF COMPOSITE MATERIALS USING THE FAIL-SAFE CONCEPT [JUSTIFICATION EN FATIGUE DE PIECES EN MATERIAU COMPOSITE BENEFICIANT DU CONCEPT FAIL SAFE]
G. Stievenard *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 5 p In FRENCH (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

A regulation established jointly between SNIAS and the Official French Service requires failure probability for any individual helicopter part below or equal to 10 to the minus 6th power. This demands knowledge of (1) the fatigue properties of the material; (2) the probability of onset of cracking in the component; and (3) the component crack propagation rate if the load spectrum is applied. Composite materials developed at Aerospatiale and used for rotors have a good fatigue life with evident fail/safe character (delayed start of delamination and slow rate of propagation). The method used at SNAIS to calculate the global risk of rupture is described. A.R.H.

N81-26132# Army Aviation Research and Development Command, Fort Eustis, Va. Applied Technology Lab.
COMBAT DAMAGE ASSESSMENT
Clarence H. Carper, Jr. *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 20 p refs (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

Ballistic damage to helicopters is discussed with primary attention given to the airframe structure. A synopsis is provided of the air defense threat systems and nature of combat damage received by Army helicopters in South Vietnam versus the threat and nature of ballistic damage anticipated in today's environment. New materials, structural concepts, and other vulnerability reduction measures presently being employed on Army helicopters and promising concepts currently under development are

addressed. An overview of the combat threats anticipated for the helicopter in the near future is included. A.R.H.

N81-26133# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

AN EVALUATION OF FATIGUE PROCEDURES FOR UK MILITARY HELICOPTERS

R. Cansdale *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 5 p (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

In many areas, the formal UK requirements concerning fatigue strength of military helicopters set out in MOD Aviation Publication 970, Volume 3, are known to be deficient, more stringent, clearance procedures stated in the Specifications against which new helicopters are procured. Current UK procedures for the fatigue substantiation of military helicopters are reviewed in the light of practical experience of testing and of service usage. The problems of demonstrating both safe lives and damage tolerance are examined. The philosophy and problems of clearing composite components are mentioned. A.R.H.

N81-26134# Civil Aviation Authority, Redhill (England). Airworthiness Div.

HELICOPTER FATIGUE: A CIVIL VIEW

H. E. LeSueur *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 4 p refs (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

The majority of catastrophic accidents to helicopters involving structure were due to fatigue of some kind, and in comparison with civil jet aircraft, the accident rate for helicopters appears to be worse by a factor of at least two. Methods currently available to reduce the number of accidents due to structural failures are described. It is suggested that some benefits should be obtained by the introduction of damage tolerant materials, the incorporation of multipath loads, and the use of vibration monitoring. A.R.H.

N81-26135# Textron Bell Helicopter, Fort Worth, Tex. Structures Technology.

HELICOPTER COMPONENT FATIGUE LIFE DETERMINATION

M. J. McGuigan *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 10 p refs (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

The fatigue evaluation program for helicopter components is reviewed and some of the uncertainties that can be encountered in each stage of the program are discussed in some detail. These include the fatigue test and the flight loads measurement phases. Also considered is the frequency of occurrence spectrum and the effects of changes in operational usage as well as possible solutions to the problem of the resulting changes in load spectrums. Variables in the final fatigue life calculations are discussed and some different approaches to setting component retirement time are discussed. In view of the existing uncertainties involved in the safe life determination process the fail safe approach is considered and some examples are discussed of damage tolerance testing for both metal and composite main rotor blades. Author

N81-26136# Societe Nationale Industrielle Aerospatiale, Marignane (France.)

FATIGUE TESTS ON THE TOTAL STRUCTURE OF THE GAZELLE SA 341 HELICOPTER [ESSAI DE FATIGUE D'UNE STRUCTURE COMPLETE DE LHELICOPTERE SA 341 GAZELLE]

Philippe Petard and Jean-Pierre Lambert (Centre D'Essais Aeronautique, Toulouse) *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 22 p In FRENCH (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

The Gazelle is a light, single turbine, 3-blade main rotor's aircraft whose structure combines metal assemblages and honeycomb structures. A pecularity of the helicopter is a drift-fenestron (fan-in-fin) which replaces the classic anti-torque rotor. This design, especially at high speeds, permits reduction of necessary force on the fenestron because of the aerodynamic action of the f drift and consequently increases the force available on the main rotor. Transl. by A.R.H.

N81-26137# Sikorsky Aircraft, Stratford, Conn. Transmission Systems Design and Development.

HELICOPTER GEARBOX TESTING

Robert Zincone and Joseph H. Mancini *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 10 p ref (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

Helicopter gearboxes have benefited from improved materials and from design concepts. However, in the design arena, exhaustive testing to verify that reliability, maintainability, and safety objectives achieved remains the key to a successful product. Overstress testing and the methods used to design the gearboxes to meet these overstress test requirements are the key issues. A gearbox designed for mission reliability will most likely have an unacceptably high risk of not passing an accelerated test. The types of tests use to qualify gearboxes to provide reliability in the field are discussed. Also discussed are the test approaches taken and the differences in acceptance criteria used by the various certifying agencies, the ramifications of overstress testing, and the reliability assessment used in the design of a modern helicopter gearbox. Author

N81-26138# Westland Helicopters Ltd., Yeovil (England).

FATIGUE TESTING OF HELICOPTER GEARBOXES

A. H. Baker *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 24 p (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

The fatigue testing of helicopter gearboxes which covers not only the gears but the casings and shafts and other parts of the gearboxes is addressed. Testing with the required factors for fatigue scatter and extrapolation leads to difficulties with the tooth meshing and premature tooth surface damage requiring modified tooth profiles and high pressure lubricants. The principal test method has been on 'back to back' rigs, but for the future, open loop testing is planned in order to give greater flexibility and versatility. A comparison of service experience with test experience is of some value in assessing the merit of the test factors. L.F.M.

N81-26139# Hughes Helicopters, Culver City, Calif. Structural Analysis Section.

THE METHODOLOGY OF FATIGUE ANALYSIS AND TESTING: MAIN ROTOR BLADES AND HUB, HUGHES YAH-64 ADVANCED ATTACK HELICOPTER

John M. McDermott *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 17 p ref (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

The fatigue methodology applied to the structural analysis and testing of the main rotor blade, blade retention system, and main rotor hub of the Hughes YAH-64 advanced attack helicopter are presented. The basic structural concepts are described, including provision of fail-safe redundant load paths, and damage tolerance. A description of the materials used for the various structural elements is given, and the factors affecting their choice are discussed. The strap retention system, which incorporates both flapping and feathering motion, is described with emphasis on its fail-safety. The approach to fatigue testing of the main rotor elements is described. Fatigue test results are presented, including failure modes and the ability of many components with large amounts of fatigue damage to sustain full loads. A description is given of the fatigue testing of parts with ballistic damage and also of the crack propagation testing of parts with a fatigue crack already developed. The analysis of failed parts to determine failure modes, origins of crack inception and possible improvements to extend fatigue life is discussed. L.F.M.

N81-26140# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

FATIGUE TESTING OF COMPOSITE ROTOR BLADES

F. Och *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 14 p refs (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

Fatigue testing methodology for composite rotor blades established and proved during the last 20 year is based on

nonlinear regression analysis. An equation with four material-dependent parameters is used to derive mean and working S/N curves between static strength and endurance limit. To calculate a scatter factor, the fatigue failure load for a given number of cycles is chosen as statistical variable. The fatigue testing program is comprised of testing coupons cut out of production blades to establish basic S/N curve shapes both for fiber and matrix failure. Coupon testing includes temperature/humidity preconditioning effects and the effect of test temperature as well as service usage on the fatigue strength of unidirectional glass fiber composite. It was found that the S/N curve shapes and scatter factors determined from coupon data could be applied to the full scale specimens. A reduction in interlaminar shear fatigue strength was found with coupons, after artificial environmental exposure. With coupons no degradation could be found, as it is with full scale speciments. Composite rotor blades show excellent damage tolerance characteristics, where damage will be indicated by changes in the eigenfrequencies, due to decreasing stiffnesses, long before the structural integrity will be questioned. L.F.M.

N81-26141# Royal Aircraft Establishment, Farnborough (England).
DEVELOPMENT OF STANDARDISED FATIGUE TEST LOAD HISTORIES FOR HELICOPTER ROTORS: BASIC CONSIDERATION AND DEFINITION OF HELIX AND FELIX
J. Darts and D. Schuetz (Fraunhofer-Inst. fuer Betriebsfestigkeit) *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 42 p refs (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

The development of two standard load histories for the fatigue evaluation of helicopter rotor materials and design details is described. The loading environment experienced by helicopter rotor components is generally around the constant amplitude fatigue limit. Realistic assessment of the fatigue performance of helicopter materials and design details by flight simulation loading therefore results in long testing times on electrohydraulic machines. The adoption of a standard loading history for such assessments should reduce the amount of testing required and greatly increase the technical value of individual test results. This is because with an agreed standard a wealth of relevant data accumulates quickly, which may negate the need for some tests and gives extensive comparative data for others. Large evaluation programs can therefore be more readily shared between different organizations and countries because the results of the program will be comparable with the organizations' own standard data and the standard data previously accumulated.
L.F.M.

N81-26142# Fraunhofer-Inst. fuer Betriebsfestigkeit, Darmstadt (West Germany).
FATIGUE TEST PROGRAM AND TEST RESULTS
D. Schuetz, H-G. Koebler, W. Schuetz (Industrieanlagen-Betriebsgesellschaft), and M. Hueck (Industrieanlagen Betriebsgesellschaft) *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 7 p (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

The estimation of fatigue life of helicopter rotor parts is obtained by application of standarized load sequences where the service and standard load spectra are very similar. Test results yield data of helicopter main rotor parts in the form of fatigue life curves. L.F.M.

N81-26143# Pisa Univ. (Italy). Inst. of Aeronautics.
FATIGUE BEHAVIOR OF HELICOPTER DYNAMIC COMPONENTS UNDER CONSTANT AMPLITUDE AND SPECTRUM LOADING
G. Cavallini, A. Lanciott, G. Aldinio (Costruzioni Aeronautiche G. Agusta), and R. Rovellotti (Costruzioni Aeronautiche G. Agusta) *In* AGARD Helicopter Fatigue Life Assessment Mar. 1981 14 p refs (For primary document see N81-26126 17-05)
Avail: NTIS HC A12/MF A01

A number of results obtained in a research helicopter fatigue are given. Various approaches to design for fatigue in helicopter components and; subsequently, an evaluation of improvement in this area were compared. Current methodologies used in helicopter industries are considered, as well as nominal stress approach, and advanced methods, namely methods based on local stress-strain approaches. Fatigue test constant amplitude and variable amplitude loading were carried out on typical dynamic component, the tail rotor mast of A 109A helicopter. Spectrum loading tests were performed using a sequence directly deduced from flight load survey. Such experimental data, and theoretical data from of all the methods considered, are then compared. Useful indications concerning fatigue evaluation methodolgies are given. L.F.M.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N81-26144*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SUBSONIC TESTS OF AN ALL-FLUSH-PRESSURE-ORIFICE AIR DATA SYSTEM
Terry J. Larson and Paul M. Siemers, III (NASA, Langley Research Center) Jun. 1981 50 p refs Presented at the 1980 Air Data Systems Conf., Colorado Springs, Colo., May 1980
(NASA-TP-1871; H-1122) Avail: NTIS HC A03/MF A01 CSCL 01D

The use of an all-flush-pressure-orifice array as a subsonic air data system was evaluated in flight and wind tunnel tests. Two orifice configurations were investigated. Both used orifices arranged in a cruciform pattern on the airplane nose. One configuration also used orifices on the sides of the fuselage for a source of static pressure. The all-nose-orifice configuration was similar to the shuttle entry air data system (SEADS). The flight data were obtained with a KC-135A airplane. The wind tunnel data were acquired with a 0.035-scale model of the KC-135A airplane. With proper calibration, several orifices on the vertical centerline of the vehicle's nose were found to be satisfactory for the determination of total pressure and angle of attack. Angle of sideslip could be accurately determined from pressure measurements made on the horizontal centerline of the aircraft. Orifice pairs were also found that provided pressure ratio relationships suitable for the determination of Mach number. The accuracy that can be expected for the air data determined with SEADS during subsonic orbiter flight is indicated. A.R.H.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-26145*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBINE BYPASS ENGINE: A NEW SUPERSONIC CRUISE PROPULSION CONCEPT
Leo C. Franciscus 1981 15 p refs Presented at the 17th Joint Propulsion Conf., Colorado Springs, Colo., 27-29 Jul. 1981; sponsored by AIAA, SAE, and ASME
(NASA-TM-82608; E-855) Avail: NTIS HC A02/MF A01 CSCL 21E

Engine performance and mission studies were carried out for a single-spool Turbine Bypass Engine concept. Comparisons were made between the TBE, a conventional single-spool turbojet, and the Pratt & Whitney Variable Stream Control Engine. The airplane assumed for the study was a Mach 2.32 commercial supersonic transport. The nominal mission was a 4000-nautical miles total range with a 300-nautical miles subsonic cruise leg. The figure of merit was the minimum takeoff gross weight for the mission. Comparisons of the three engines were also made for the 4000-nautical miles total range with longer subsonic cruise legs. Author

N81-26146*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SMALL GAS-TURBINE COMBUSTOR STUDY: FUEL INJECTOR EVALUATION
Carl T. Norgren and Stephen M. Riddlebaugh 1981 20 p refs Presented at the Joint Propulsion Conf., Colorado Springs, Colo., 27-29 Jul. 1981; sponsored by AIAA, SAE, and ASME
(NASA-TM-82641; E-891) Avail: NTIS HC A02/MF A01 CSCL 21E

As part of a continuing effort at the Lewis Research Center to improve performance, emissions, and reliability of turbine machinery, an investigation of fuel injection technique and effect of fuel type on small gas turbine combustors was undertaken. Performance and pollutant emission levels are documented over a range of simulated flight conditions for a reverse flow combustor configuration using simplex pressure-atomizing, spill-flow return, and splash cone airblast injectors. A parametric evaluation of the effect of increased combustor loading with each of the fuel injector types was obtained. Jet A and an experimental referee broad specification fuel were used to determine the effect of fuel type. Author

N81-26147* National Aeronautics and Space Administration, Washington, D. C.
TESTING OF CERAMIC GAS TURBINE COMPONENTS UNDER SERVICE-LIKE CONDITIONS
Wilhelm Siebmanns Apr. 1980 10 p refs Transl. into ENGLISH from Berichte der Deutschen Keramische Gesellschaft (West Germany), v. 55, no. 8, 1978 p 406-409 Transl. by Scientific Translations, Inc., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75781) Avail: NTIS HC A02/MF A01 CSCL 21E

The German firm MTU, Munich, West Germany, is developing gas turbine components made of special ceramics (silicon nitride, silicon carbide) which can withstand temperatures up to 1600 K. Various components such as the combustor and turbine wheel are being developed. Various preliminary tests of components are discussed. Author

N81-26148*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SIMPLIFIED DESIGN POINT PERFORMANCE MODEL OF A DRY TURBOFAN ENGINE CYCLE
Frederick J. Lallman May 1981 22 p
(NASA-TM-83112) HC A02/MF A01 CSCL 21E

The specific thrust and fuel-air ratios for the cycle were calculated over a range of altitudes and Mach numbers. The engine has a fan pressure ratio of 2.9, compressor pressure ratio of 8.0, and bypass ratio of 0.6. A simplified model of the specific thrust and fuel-air ratio involving look-up tables and simple algebraic equations was empirically derived from the calculated data. T.M.

N81-26149# Comptroller General of the United States, Washington, D.C.
A LOOK AT NASA'S AIRCRAFT ENERGY EFFICIENCY PROGRAM
28 Jul. 1980 94 p refs
(PSAD-80-50) Avail: NTIS HC A05/MF A01

The status of the program, the coordination effectiveness between NASA and the Department of Defense, the need for periodic reporting to the Congress on efforts such as ACEE, and NASA's role in aeronautical research and development were examined. Emphasis is placed on the development of technologies which would make future transport aircraft up to 50% more fuel efficient than current models. T.M.

N81-26150# Naval Research Lab., Washington, D. C.
AN ASSESSMENT OF THE USE OF CERAMICS IN HEAT ENGINES Final Report, 1979 - 1980
R. W. Rice 18 May 1981 46 p
(DARPA Order 3600)
(AD-A098995; NRL-MR-4499) Avail: NTIS HC A03/MF A01 CSCL 11/2

The starting point for this assessment was the failure of the DARPA/Navy/Garrett Ceramic Turbine Program to meet the 50 hour engine demonstration goal. Of particular pertinence to this assessment is that the rotating components appear to have been successful, but that this success and its extent were hidden by static component failure leading to complete engine failure. The basic assessment of ceramics in heat engines is that extensive application is feasible and extremely important. Feasibility is shown by the success of various components in the different demonstration programs which were often not totally successful because of the ambitious, complex nature of these programs. The importance of ceramics for heat engines is demonstrated by the impact of ceramic usage on consumption of both fuel and strategic metals, as well as by its potential impact on large industrial sectors in the United States and the serious economic competition with Europe and especially Japan. The immediate need from the Garrett program is to determine the extent of success of ceramic bladed metal rotors. This has potential practical payoff since in some applications ceramic blades may be used as the only ceramic components in a metal engine with over 50% of the benefit of using ceramics as both blades and vanes. However, since ceramic static hardware has an important contribution to make, solutions to the static hardware problems, much of which appears to be due to contact stresses between ceramic components, must be sought. GRA

N81-26151# Naval Ship Research and Development Center, Bethesda, Md. Dept. of Aviation and Surface Effects.
LIFT-PROPULSION SYSTEM WEIGHT VARIATION FOR VERY HEAVY LIFT HELICOPTERS
Peter S. Montana Sep. 1980 36 p refs
(ZF66412001)
(AD-A099169; DTNSRDC/ASED-80/25) Avail: NTIS HC A03/MF A01 CSCL 21/5

The lift-propulsion system (LPS) weights of single and tandem rotor shaft-driven helicopters and single rotor tip-driven helicopters were estimated using weight trend equations for vehicle gross weights up to 250,000 lb (113,636 kg). The tip-driven helicopter configuration had the lowest LPS weight over the entire gross weight range and the greatest potential for achieving useful loads in excess of 60,000 lb (27,216 kg). Results of the sensitivity analysis indicate that disc loading, number of blades, and solidity of the main rotor are the most significant parameters affecting LPS weight. The application of circulation control rotor technology to very large helicopters with tip-driven rotors can reduce LPS weight by as much as 19 percent. Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-26152* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PITCH ATTITUDE STABILIZATION SYSTEM UTILIZING ENGINE PRESSURE RATIO FEEDBACK SIGNALS Patent
Wendell W. Kelley, inventor (to NASA) Issued 12 May 1981 7 p Filed 28 Feb. 1979 Supersedes N79-20135 (17 - 11, p 1394)
(NASA-Case-LAR-12562-1; US-Patent-4,266,743; US-Patent-Appl-SN-015995; US-Patent-Class-244-182; US-Patent-Class-244-181) Avail: US Patent and Trademark Office CSCL 01C

The changes in the engine pressure ratio signals which result from thrust changes are used to generate a pitch stabilization signal. The signal is combined with other pitch control signals to automatically counteract pitching moments resulting from the changes in engine thrust.
Official Gazette of the U.S. Patent and Trademark Office

N81-26153 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A STUDY OF THE EFFECTS OF STORE AERODYNAMIC ON WING/STORE FLUTTER Ph.D. Thesis
Charlie Daniel Turner 1980 83 p
Avail: Univ. Microfilms Order No. 8110479

A large number of wing/store single carriage configurations parameters were included, multivariate analysis techniques were

used to analyze wing/store configuration, modal data, and flutter results. The inclusion of both tip store and underwing store aerodynamics can cause large variations in the computed flutter speed, when compared to results obtained when these effects are ignored. In the majority of the configurations analyzed, the flutter mechanism remained unchanged with the addition of the store aerodynamics which allowed for the use of multivariate analysis techniques. The results of the factor analysis indicate that it may not be possible to develop general guidelines or to predict store aerodynamic effects that will apply to all aircraft, and it is possible to develop specific guidelines or to predict store aerodynamic effects that will apply to given aircraft.
Dissert. Abstr.

N81-26154*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
CORRELATION OF PREDICTED AND FLIGHT DERIVED STABILITY AND CONTROL DERIVATIVES WITH PARTICULAR APPLICATION TO TAILLESS DELTA WING CONFIGURATIONS
Joseph Weil Jul. 1981 42 p refs
(NASA-TM-81361) Avail: NTIS HC A03/MF A01 CSCL 01C

Flight derived longitudinal and lateral-directional stability and control derivatives were compared to wind-tunnel derived values. As a result of these comparisons, boundaries representing the uncertainties that could be expected from wind-tunnel predictions were established. These boundaries provide a useful guide for control system sensitivity studies prior to flight. The primary application for this data was the space shuttle, and as a result the configurations included in the study were those most applicable to the space shuttle. The configurations included conventional delta wing aircraft as well as the X-15 and lifting body vehicles.
Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N81-26155*# Dayton Univ., Ohio.
EVALUATION OF MOIRE TECHNIQUES FOR WIND TUNNEL METROLOGY Interim Report, 4 Jan. - 30 Jun. 1981
J. S. Harris and K. G. Harding Jun. 1981 17 p refs
(Grant NAG1-143)
(NASA-CR-164477) Avail: NTIS HC A02/MF A01 CSCL 14B

The development of a moire technique suitable for the analysis of object deflections in a cryogenically cooled, transonic wind tunnel is described. The operating environment for the wind tunnel has a temperature range of 77 to 3390 K, pressure to 91390 Kgs/sq m, and noise to 150 dB SPL. Efforts were made to accomplish the following: to demonstrate projection moire as it would be used to study structural deflections; to use optical processing to multiply the sensitivity of the moire; and to investigate a system design based on the requirements of the wind tunnel geometry.
R.C.T.

N81-26156*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
DEVELOPMENT AND EVALUATION OF A PROTOTYPE IN-FLIGHT INSTRUMENT FLIGHT RULES (IFR) PROCEDURES TRAINER Final Report
Jennings B. Aaron, Jr. and Gerald G. Morris Jun. 1981 34 p
(NASA-TM-73292) Avail: NTIS HC A03/MF A01 CSCL 14B

An in-flight instrument flight rules (IFR) procedures trainer capable of providing simulated indications of instrument flight in a typical general aviation aircraft independent of ground based navigation aids was developed. The IFR navaid related instruments and circuits from an ATC 610J table top simulator were installed in a Cessna 172 aircraft and connected to its electrical power and pitot static systems. The benefits expected from this hybridization concept include increased safety by reducing the number of general aviation aircraft conducting IFR training flights in congested terminal areas, and reduced fuel use and instruction costs by lessening the need to fly to and from navaid equipped airports and by increased efficiency of the required in-flight training. Technical feasibility was demonstrated and the operational feasibility of the concept was evaluated. Results indicated that the in-flight simulator is an effective training device for teaching IFR procedural skills.
E.A.K.

N81-26157*# Boeing Co., Seattle, Wash.
LASER ANGLE SENSOR DEVELOPMENT Final Report, 1979 - 1980
C. R. Pond and P. D. Texeira Hampton, Va. NASA. Langley Research Center Oct. 1980 73 p
(Contract NAS1-15987)
(NASA-CR-159385; NASA-159306) Avail: NTIS HC A04/MF A01 CSCL 14B

Electrical and optical parameters were developed for a two-axis (pitch/roll) laser angle sensor. The laser angle sensor was a fringe counting interferometer, where interference fringes were generated by a small passive reflecting element on the model. The laser source and detector were mounted in the plenum above the model. Two axis optical distortion measurements of flow characteristics in 0.3 miransonic cryogenic tunnel were made with a shearing interferometer. The measurement results provided basis for estimating the optical parameters of the laser angle sensor. Experimental and analytical information was generated on model windows to cover the reflector. A two-axis breadboard was assembled to evaluate different measurement concepts. The measurement results were used to develop a preliminary design of a laser angle sensor.
R.C.T.

N81-26158*# National Aeronautics and Space Administration, Washington, D. C.
MEASUREMENTS OF TEMPERATURE AND PRESSURE FLUCTUATIONS IN THE T PRIME 2 CRYOGENIC WIND TUNNEL
A. Blanchard, J. B. Dor, and J. F. Breil Oct. 1980 48 p Transl. into ENGLISH of "Mesures des Fluctuations de Temperature et de Pression dans la Soufflerie Cryogenique T prime 2" (Toulouse), OA8/5007 and DERAT No. 8,5007 DN, Jan. 1980 22 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre d'Etudes et de Recherches de Toulouse, France
(Contract NASw-3199)
(NASA-TM-75408) Copyright. Avail: NTIS HC A03/MF A01 CSCL 14B

Cold wire measurement of temperature fluctuations were made in a DERAT T'2 induction powered cryogenic wind tunnel for 2 types of liquid nitrogen injectors. Thermal turbulence measured in the tranquilization chamber depends to a great extent on the injector used; for fine spray of nitrogen drops, this level of turbulence seemed completely acceptable. Fluctuations in static pressure taken from the walls of the vein by Kulite sensors showed that there was no increase in aerodynamic noise during cryogenic gusts.
Author

N81-26159*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
DIGITAL CONTROLLERS FOR THE VERTICAL CHANNELS OF A MAGNETIC SUSPENSION SYSTEM
P. W. Fortescue and C. Bouchalis May 1981 35 p
(Grant NsG-7523)
(NASA-CR-165684) Avail: NTIS HC A03/MF A01 CSCL 14B

The Southhampton University magnetic suspension system has an analog controller which is being replaced by a digital filter. During the first stage of conversion, two of the six degrees of freedom (vertical heave and pitch) were fitted with a digital version of the analog filters. Direct replacements for the analog phase advance filters were used and performance comparisons were made. A mathematical model of the magnetic coils and suspended model was developed for small angle use.
Author

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N81-26160*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVA ASSEMBLY OF LARGE SPACE STRUCTURE ELEMENT
Laurence J. Bement, Harold G. Bush, Walter L. Heard, Jr., and Jack W. Stokes, Jr. (NASA, Marshall Space Flight Center) Jun. 1981 38 p refs
(NASA-TP-1872; L-14353) Avail: NTIS HC A03/MF A01 CSCL 22A

The results of a test program to assess the potential of manned extravehicular activity (EVA) assembly of erectable space trusses are described. Seventeen tests were conducted in which six 'space-weight' columns were assembled into a regular tetrahedral cell by a team of two 'space'-suited test subjects. This cell represents the fundamental 'element' of a tetrahedral truss structure. The tests were conducted under simulated zero-gravity conditions. Both manual and simulated remote manipulator system modes were evaluated. Articulation limits of the pressure suit and zero gravity could be accommodated by work stations with foot restraints. The results of this study have confirmed that astronaut EVA assembly of large, erectable space structures is well within man's capabilities. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N81-26161* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ORIBTER/LAUNCH SYSTEM Patent
Liam R. Jackson, John P. Weidner, William J. Small, and James A. Martin, inventors (to NASA) Issued 5 May 1981 6 p Filed 30 May 1978 Supersedes N78-25120 (17 - 16, p 2081)
(NASA-Case-LAR-12250-1; US-Patent-4,265,416; US-Patent-Appl-SN-910794; US-Patent-Class-244-2; US-Patent-Class-244-160; US-Patent-Class-244-63) Avail: US Patent and Trademark Office CSCL 22D

The system includes reusable turbojet propelled booster vehicles releasably connected to a reusable rocket powered orbit vehicle. The coupled orbiter-booster combination takes off horizontally and ascends to staging altitude and speed under booster power with both orbiter and booster wings providing lift. After staging, the booster vehicles fly back to Earth for horizontal landing and the orbiter vehicle continues ascending to orbit.Official Gazette of the U.S. Patent and Trademark Office

N81-26162# Air Force Engineering and Services Center, Tyndall AFB, Fla. Environics Div.
ACCIDENTAL IMPACT DESCRIPTOR APPLICATION METHODOLOGY Final Report, 31 Mar. - 1 Aug. 1980
James D. Thompson and Donal R. Myrick Aug. 1980 48 p
(AF Proj. 2103)
(AD-A099304; AFESC/ESL-TR-80-41) Avail: NTIS HC A03/MF A01 CSCL 19/4

This report provides the intended user of accidental impact descriptors for Air Force air-to-ground weapon range planning activities a brief summary of their development, the step-by-step procedure for properly applying them, and an example problem. The descriptors are provided in Appendix A. These descriptors show containment contours for significant percentages of impacts resulting from weapon delivery training and weapon tests conducted in the last 12 years. The application methodology is adapted from a previous report and includes qualifications for use of composite descriptors, identification of hazard potential areas, and resolution of land-use conflicts. If the graphical solutions presented in this report do not resolve a particular land-use conflict, further analysis is recommended. Author (GRA)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-26163*# National Aeronautics and Space Administration, Washington, D. C.
GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE (GOES-E) MISSION OPERATION REPORT
28 Apr. 1981 37 p
(NASA-TM-82380; E-612-81-03) Avail: NTIS HC A03/MF A01 CSCL 22A

The Visible Infrared Spin Scan Radiometer (VISSR) was modified from the original design to incorporate an atmospheric sounding capability to measure temperature and water content at various altitude layers. The three stage, inertially guided Delta launch vehicle, utilizing a Thor booster with nine solid motors for thrust augmentation, a TR-201 second stage, and TE-364-4 third stage is described. It will be used to inject GOES-E into a transfer orbit from which the spacecraft's apogee boost motor can place the spacecraft into a synchronous orbit. The spacecraft will then be temporarily stationed at 85 deg W longitude for continued performance of the VAS demonstration experiment, until needed as the eastern operational spacecraft. T.M.

N81-26164*# Communications Satellite Corp., Clarksburg, Md.
GEOSTATIONARY PLATFORMS MISSION AND PAYLOAD REQUIREMENTS STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report, 12 Oct. 1978 - 18 Oct. 1979
30 Oct. 1979 93 p refs 2 Vol.
(Contract NAS8-33226)
(NASA-CR-161807) Avail: NTIS HC A05/MF A01 CSCL 22B

Time-phased missions and payloads for potential accommodation on geostationary platforms and the engineering requirements placed upon the platform housekeeping elements by selected payloads are identified. Optimum locations for geostationary platforms, potential missions and their characteristics, and potential user requirements were determined as well as the interface requirements between the missions and h the geostationary platform. A payload data book was prepared and antenna tradeoff studies were conducted. Payload missions are defined in terms of frequencies, power, beam patterns, interconnections, support requirements, and other characteristics. J.M.S.

N81-26165*# Communications Satellite Corp., Clarksburg, Md.
GEOSTATIONARY PLATFORMS MISSION AND PAYLOAD REQUIREMENTS STUDY. VOLUME 2: TECHNICAL Final Report, 12 Oct. 1978 - 18 Oct. 1979
30 Oct. 1979 151 p refs 2 Vol.
(Contract NAS8-33226)
(NASA-CR-161808) Avail: NTIS HC A08/MF A01 CSCL 22B

The possibility of using geostationary platforms to provide communications and other services was examined. Detailed data on the payload and housekeeping requirements of selected communications missions and one typical noncommunications mission are presented. J.M.S.

N81-26166*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRUCTURAL DYNAMICS AND CONTROL OF LARGE SPACE STRUCTURES
E. Burton Lightner, comp. Jun. 1981 136 p refs Proc. held at Hampton, Va., 30-31 Oct. 1980
(NASA-CP-2187; L-14609) Avail: NTIS HC A07/MF A01 CSCL 22B

The focus of the workshop was the basic research program assembled by LaRC to address the fundamental technology deficiencies that were identified in several studies on large space systems (LSS) conducted by NASA in the last several years. The staffs of the respective participants were assembled at the workshop to review the current state of research in the control technology for large structural systems and to plan the efforts that would be pursued by their respective organizations. T.M.

N81-26167# Army Missile Command, Redstone Arsenal, Ala. Systems Simulation and Development Directorate.
EFFECT OF FOREBODY WING STRAKES ON ENHANCING PERFORMANCE OF A TYPICAL BODY-WING-TAIL MISSILE CONFIGURATION AT MACH 2.0
Pamela K. Alstott and William D. Washington Aug. 1980 36 p refs
(AD-A099321; AD-E950125; DRSMI/RD-80-13-TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The addition of forebody strakes to aircraft configurations have shown significant improvement in aircraft performance at moderate to high angles of attack for subsonic and transonic speeds. This research project investigates the effect of strakes on missile type body-wing-tail configurations at supersonic speeds by conducting a (1) literature survey of related existing data and design methods and (2) analyzing a new set of wind tunnel data on a body-wing-tail missile configuration with added forebody strakes at Mach 2.0. Findings from the literature survey are presented. Analysis of the wind tunnel data reveals that added forebody strakes do not significantly improve missile performance at Mach 2.0 and angles of attack up to 20 degrees for the configuration tested. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N81-26168*# Wichita State Univ., Kans. Dept. of Aeronautical Engineering.
AN EXPLORATORY INVESTIGATION OF WEIGHT ESTIMATION TECHNIQUES FOR HYPERSONIC FLIGHT VEHICLES
Everett L. Cook [1981] 112 p refs
(Contract NCC1-21)
(NASA-CR-164420) Avail: NTIS HC A06/MF A01 CSCL 22B

The three basic methods of weight prediction (fixed-fraction, statistical correlation, and point stress analysis) and some of the computer programs that have been developed to implement them are discussed. A modified version of the WAATS (Weights Analysis of Advanced Transportation Systems) program is presented, along with input data forms and an example problem. M.G.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N81-26169*# LinCom Corp., Pasadena, Calif.
ORBITER GLOBAL POSITIONING SYSTEM DESIGN AND Ku-BAND PROBLEMS INVESTIGATION, EXHIBIT B, REVISION 1 Interim Report
C. M. Chie and W. R. Braun May 1981 93 p ref
(Contract NAS9-16097)
(NASA-CR-161009; TR-0581-0980) Avail: NTIS HC A05/MF A01 CSCL 22A

The LinCom effort in supporting the JSC study of the use of the Global Positioning System (GPS) on the space shuttle and in Ku-band problem investigation is documented. LinCom was tasked to evaluate system implementation, performance, and integration aspects of the shuttle GPS and to provide independent technical assessment of reports submitted to JSC regarding integration studies, system studies and navigation analyses. Author

N81-26170# Naval Underwater Systems Center, New London, Conn. Dept. of Surface Ship Sonar.
A GAIN STEP COMPANDING (COMPRESSING EXPANDING) ANALOG-TO-DIGITAL CONVERTER
Gerald L. Assard 30 Mar. 1981 24 p ref
(ARPA Order 2976)
(AD-A099381; NUSC-TD-6317) Avail: NTIS HC A02/MF A01 CSCL 09/5

A novel scheme for analog-to-digital conversion is described. This scheme provides a dynamic range in excess of 120 dB, yet requires an output of only 9 bits. These 9 bits are utilized to transmit a companded digital word format including sign information. Use of this companded output format results in significant transmit bandwidth reduction compared with transmit bandwidths required for conventional linear bit formats. This companding results in a worst case error of 3.125%. Author (GRA)

N81-26171# Naval Underwater Systems Center, New London, Conn. Dept. of Surface Ship Sonar.
SIGN POLAR RETURN-TO-ZERO TELEMETRY AND CODING LOGIC
Gerald L. Assard 30 Mar. 1981 19 p
(ARPA Order 2976)
(AD-A099382; NUSC-TD-6399) Avail: NTIS HC A02/MF A01 CSCL 09/6

An existing telemetry scheme employs Bipolar Return-to-Zero (BPRZ) logic to encode binary information. The BPRZ provides for trilevel waveform pulse code modulation; however, the current implementation does not use the full capacity of the BPRZ logic. Sign Polar Return-to-Zero encoding exploits the remaining encoding capacity to provide an additional bit transfer per channel word. This implementation transfers the word argument sign information by the polarity encoding of the first nonzero pulse in each telemetry word pulse encoded waveform. Significant increase in data transfer efficiency is provided in this technique. Author (GRA)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-26172*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PROPOSED DYNAMIC PHASE DIFFERENCE METHOD FOR THE DETECTION OF TILE DEBONDING FROM THE SPACE SHUTTLE ORBITER
Allan J. Zuckerwar and Danny R. Sprinkle Jun. 1981 14 p refs
(NASA-TM-83140) Avail: NTIS HC A02/MF A01 CSCL 22B

A noncontracting, semi-global, dynamic technique was developed for detecting loose tiles on the space shuttle orbiter. In laboratory tests on a single tile, the substrate was excited into lateral motion at a constant frequency and amplitude of 2g. The phase relationship between the motions of tile and substrate was examined by noncontacting probes in order to relate the dynamic properties of the tile SIP system to its fatigue history; by a visual technique using a stroboscope and split screen video monitor for practical application in the field. When the substrate is excited at an appropriate frequency (between 30 and 60 Hz), a good tile moves in phase and a loose tile out of phase with the substrate. The out of phase motion is readily observable in the form of a 'beat' between the tile and a reference marker on the substrate. A.R.H.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-26173*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DETERMINATION OF OPTIMUM SUNLIGHT CONCENTRATION LEVEL IN SPACE FOR GALLIUM ARSENIDE SOLAR CELLS

Henry B. Curtis 1981 8 p refs Presented at the 15th Photovoltaic Spec. Conf., Kissimmee, Fla., 12-15 May 1981; sponsored by the Inst. of Electrical and Electronics Engineers (NASA-TM-82643; E-898) Avail: NTIS HC A02/MF A01 CSCL 10A

The solar cell diode equation was used to calculate the optimum values, or range of values of concentration ratios. A variety of temperature vs. concentration assumptions were used and cell area and series resistance were varied. The coefficients of the diffusion and recombination terms vary strongly with temperature while the light generated current is a weak function of temperature and proportional to concentration. The study indicates that the cell temperature vs. concentration ratio assumption is critical. It appears that concentration levels of approximately 100X are feasible in space. T.M.

N81-26174*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SERT 2 THRUSTERS: STILL TICKING AFTER ELEVEN YEARS

W. R. Kerslake 1981 23 p refs Presented at the 17th Joint Propulsion Conf., Colorado Springs, Colo., 27-29 Jul. 1981 sponsored by AIAA, SAE and ASME

(NASA-TM-81774; E-835) Avail: NTIS HC A02/MF A01 CSCL 21C

The performance and durability of the ion thruster system and components are discussed. Interactions between the ion thruster and the space plasma-spacecraft interfaces were examined. The application of the results of testing the thruster to designing future ion thrusters is emphasized. T.M.

N81-26175*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

DESIGN STUDY FOR IMPROVED ION THRUSTER POWER PROCESSOR. VOLUME 1: SUMMARY Final Report, Oct. 1978 - Nov. 1980

J. J. Biess and L. Y. Inouye Dec. 1980 124 p refs 2 Vol. (Contract NAS3-21746)

(NASA-CR-165288-Vol-1; TRW-34309-6001-RU-01-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 21C

Some of the power processor technology improvements discussed are: the design of the series resonant inverter control and protection logic, and regulation electronics using CMOS integrated circuits; the use of power FET transistors for inverter base drive and regulator circuitry; the use of Westinghouse D60T transistors in a 20 KHz series resonant inverter power stage; film capacitor improvements and testing; and the use of heat pipe cooled power magnetics. A converter funded technical effort is also reported on. This effort includes: the design and fabrication of a digital interface module and a transistorized series resonant beam supply module, integration of these two modules into the power processor, and the successful integration and operation of the power processor with a 30 cm ion thruster. T.M.

N81-26176*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

DESIGN STUDY FOR IMPROVED ION THRUSTER POWER PROCESSOR. VOLUME 2: DESIGN DETAILS Final Report, Oct. 1978 - Nov. 1980

J. J. Biess and L. Y. Inouye Dec. 1980 163 p 2 Vol. (Contract NAS3-21746)

(NASA-CR-165288-Vol-2; TRW-34309-6001-RU-01-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 21C

A photo of the module showing power and control electronics is presented. Schematics of the module subsections are included. The module test data is summarized and discussed. T.M.

N81-26177*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.

INERT GAS THRUSTERS Annual Report

Harold R. Kaufman and Raymond S. Robinson Dec. 1980 94 p refs

(Grant NsG-3011)

(NASA-CR-165332) Avail: NTIS HC A05/MF A01 CSCL 21C

Some advances in component technology for inert gas thrusters are described. The maximum electron emission of a hollow cathode with Ar was increased 60-70% by the use of an enclosed keeper configuration. Operation with Ar, but without emissive oxide, was also obtained. A 30 cm thruster operated with Ar at moderate discharge voltages give double-ion measurements consistent with a double ion correlation developed previously using 15 cm thruster data. An attempt was made to reduce discharge losses by biasing anodes positive of the discharge plasma. The reason this attempt was unsuccessful is not yet clear. The performance of a single-grid ion-optics configuration was evaluated. The ion impingement on the single grid accelerator was found to approach the value expected from the projected blockage when the sheath thickness next to the accelerator was 2-3 times the aperture diameter. R.C.T.

N81-26178# Tennessee Univ. Space Inst., Tullahoma.

DIAGNOSTIC METHODS FOR PARTICLE PROPERTY MEASUREMENTS IN SOLID ROCKET MOTOR PLUMES Final Report, 1 Sep. 1978 - 30 Jun. 1979

W. M. Farmer, K. E. Harwell, and R. H. Kohl Arnold AFS, Tenn. AEDC May 1981 164 p refs

(Contract F40600-78-C-0004)

(AD-A099299; AEDC-TR-80-26) Avail: NTIS HC A08/MF A01 CSCL 21/8

An analysis of optical instrumentation techniques for particle property measurements in solid rocket motor exhaust plumes is presented. Operational limitations of the fringe type dual scatter, transit time, and local oscillator systems are presented in detail. In addition, two particle sizing interferometer systems were evaluated. State-of-the-art optical systems are reviewed and evaluated for particle velocity, particle size, and number density measurements. Particle diffusion spectroscopy, Schlieren correlation, and the radiating particle velocimeter were examined and recommended for measurement of particle size, mass density, and particle temperature. An ultraviolet forward Mie scattering computer code was used to examine ultraviolet scattering patterns from particles. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N81-26179* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD FOR ALLEVIATING THERMAL STRESS DAMAGE IN LAMINATES Patent
Charles A. Hoffman, John W. Weeton, and Norman W. Orth, inventors (to NASA) Issued 19 May 1981 5 p Filed 20 Feb. 1980 Division of US Patent Appl. SN-893857, filed 6 Apr. 1979, US Patent-4,211,354
(NASA-Case-LEW-12493-2; US-Patent-4,267,953; US-Patent-Appl-SN-122967; US-Patent-4,211,354; US-Patent-Appl-SN-893857; US-Patent-Class-228-118; US-Patent-Class-228-190) Avail: US Patent and Trademark Office CSCL 11D

The method is for metallic matrix composites, such as laminated sheet or foil composites. Non-intersecting discrete discontinuities are positively introduced into the interface between the layers so as to reduce the thermal stress produced by unequal expansion of the materials making up the composite. The discontinuities are preferably produced by drilling holes in the metallic matrix layer. However, a plurality of discrete elements may be used between the layers to carry out this purpose.
Official Gazette of the U.S. Patent and Trademark Office

N81-26180 Virginia Polytechnic Inst. and State Univ., Blacksburg.
CONTROL OF INTERFACE REACTIONS IN SiC/Ti COMPOSITES AND AN X-RAY DIFFRACTION STUDY OF INTERDIFFUSION BETWEEN Al THIN FILMS AND Ti SUBSTRATES Ph.D. Thesis
Venkatraman B. Rao 1980 314 p
Avail: Univ. Microfilms Order No. 8110473

Two mechanisms which lower the growth rate of silicides about the SiC/Ti interface were investigated. Planar composites that incorporated Mo5Si3 or Al films were compared with the uncoated SiC/Ti standards to investigate the barrier and rejection mechanisms respectively. Also, SiC/Ti3Al/Ti composites were used to study the effectiveness of the two mechanisms combined, with the Ti3Al acting as a barrier and with Ti(Al) retarding the reaction by rejection. Samples were vacuum-annealed at 875 C for various times and examined by X-ray diffraction techniques. The results from the SiC/Al/Ti and SiC/Ti3Al/Ti composites indicated that silicide formation would be retarded in presence of an Al saturated Ti matrix. Also, the formation of a Ti3Al layer near the SiC/Ti interface serves as an effective barrier to diffusion of Si atoms. In the SiC/Mo5Si3/Ti composites however, the dissociation of the Mo5Si3 phase formed during sample preparation results in additional silicide formation at the interfaces. Dissert. Abstr.

N81-26181 Wyoming Univ., Laramie.
THREE-DIMENSIONAL ELASTOPLASTIC FINITE ELEMENT ANALYSIS OF LAMINATED COMPOSITES Ph.D. Thesis
Mohamed M. Monib 1980 144 p
Avail: Univ. Microfilms Order No. 8111609

A three dimensional elastoplastic analysis of generally orthotropic composite laminates is developed, together with a finite element computer code NCLAP for its implementation. The analysis is capable of handling any laminated composite subjected to triaxial mechanical and/or hygrothermal loading conditions. The laminates can consist of any number of orthotropic material plies, of any orientations. Elastoplastic material behavior is included by means of the tangent modulus method. The onset of plastic deformation is determined by the use of a yield surface which is dependent on temperature and moisture content in the composite. Failure is also determined by a failure surface in three dimensional space, and is likewise dependent on temperature and moisture. Dissert. Abstr.

N81-26182 Washington Univ., Seattle.
THE LAYER STRUCTURE CHARACTERIZATION OF CARBON MATERIALS BY LASER RAMAN SPECTROSCOPY Ph.D. Thesis
Ronnie Paul Vidano 1980 270 p
Avail: Univ. Microfilms Order No. 8109783

Raman spectra of a wide variety of carbon materials were surveyed to investigate the influence of microstructure and structural perfection on spectral characteristics. Materials investigated from the major precursor categories (mesophase, polymeric, CVD) had a wide range of graphitizabilities and heat treatment temperature (HTT) from 1000 to 3000 C. Significant results are reported. Dissert. Abstr.

N81-26183*# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF ORTHOTROPIC BIREFRINGENT MATERIALS FOR PHOTOELASTIC STRESS ANALYSIS Final Report, Sep. 1978 - Nov. 1980
I. M. Daniel, T. Niiro, and G. M. Koller Hampton, Va. NASA. Langley Research Center May 1981 79 p refs
(Contract NAS1-15541)
(NASA-CR-165709; IITRI-M06044) Avail: NTIS HC A05/MF A01 CSCL 11D

Materials were selected and fabrication procedures developed for orthotropic birefringent materials. An epoxy resin (Maraset 658/558 system) was selected as the matrix material. Fibers obtained from style 3733 glass cloth and type 1062 glass roving were used as reinforcement. Two different fabrication procedures were used. In the first one, layers of unidirectional fibers removed from the glass cloth were stacked, impregnated with resin, bagged and cured in the autoclave at an elevated temperature. In the second procedure, the glass roving was drywound over metal frames, impregnated with resin and cured at room temperature under pressure and vacuum in an autoclave. Unidirectional, angle-ply and quasi-isotropic laminates of two thicknesses and with embedded flaws were fabricated. The matrix and the unidirectional glass/epoxy material were fully characterized. The density, fiber volume ratio, mechanical, and optical properties were determined. The fiber volume ratio was over 0.50. Birefringent properties were in good agreement with predictions based on a stress proportioning concept and also, with one exception, with properties predicted by a finite element analysis. Author

N81-26184*# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
APPLICATION OF THE CUBIC STRENGTH CRITERION TO THE FAILURE ANALYSIS OF COMPOSITE STRUCTURES
R. C. Tennyson May 1981 85 p refs
(Grant NsG-7409)
(NASA-CR-165712) Avail: HC A05/MF A01 CSCL 11D

A combined analytical and experimental investigation of the failure of composite laminates in a plane stress state is described. Strength predictions based on both the cubic and quadratic formulations are presented and the results compared to test data for both simple and complex biaxial loading. Multi-mode failure cases were also studied, including combined loading. In most instances it was demonstrated that the quadratic criterion does not provide accurate strength predictions and leads to overestimates for some configurations. Test data are included on the effect of prolonged thermal-vacuum cycling on the change in matrix stiffness and tensile strength. Results are presented for a graphite/epoxy prepreg which was subjected to over one year's exposure in a space simulator. S.F.

N81-26185*# Southwest Research Inst., San Antonio, Tex. Dept. of Fire Technology.
FIRE TEST METHODOLOGY FOR AEROSPACE MATERIALS. 1: THERMAL AND SMOKE TOXICOLOGICAL ASSESSMENTS OF GRAPHITE/BISMALEIMIDE AND GRAPHITE/EPOXY SYSTEMS Final Report
M. D. Kanakia, W. G. Switzer, G. E. Hartzell, and H. L. Kaplan Oct. 1980 124 p refs

(Contract NAS2-10140)
(NASA-CR-166196; SWRI-03-5565-001) Avail: NTIS HC A06/MF A01 CSCL 11D

Both materials possess a high degree of thermal stability, with total heat release values being essentially identical under piloted ignition conditions over a range of 5 to 10 W/sq cm incident heat flux. The graphite/epoxy material had a tendency to auto-ignite at a lower heat flux (about 7 W/sq cm) and produced about 23 percent higher peak heat release rates, approximately 42 percent more carbon monoxide and considerably more smoke than the graphite/bismaleimide under conditions of piloted ignition. Toxicological potencies of smoke produced from the two composites were equivalent for 30 minute exposures. Potencies were also comparable to many common materials, such as wood. There was no evidence for the formation of an 'unusual toxicant' nor for any short term post-exposure toxicological effects. T.M.

N81-26186# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ANALYSIS OF LAYERED COMPOSITE PLATES ACCOUNTING FOR LARGE DEFLECTIONS AND TRANSVERSE SHEAR STRAINS Interim Report
J. N. Reddy May 1981 54 p refs Proposed for presentation at the 1981 ASME Vibration Conf., Hartford, Conn., 15-20 Sep. 1981 Submitted for publication
(Contract N00014-78-C-0647; Grant AF-AFOSR-0142-80; NR Proj. 064-609)
(AD-A098913; VPI-E-81-12; TR-21) Avail: NTIS HC A04/MF A01 CSCL 11/14

A finite-element analysis is presented for large-deflection bending and large-amplitude free vibration of rectangular plates of cross-ply and angle-ply construction under various edge conditions and loadings. The finite element employed in the present study accounts for transverse shear and rotatory inertia (in the Reissner-Mindlin sense), and large rotations (in the von Karman sense). The finite element solutions are found to agree very closely with results available in the literature. Author (GRA)

N81-26187# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ON THE BEHAVIOR OF PLATES LAMINATED OF BIMODULUS COMPOSITE MATERIALS
J. N. Reddy and C. W. Bert Apr. 1981 26 p refs Presented at the First Japan - US Conf. on Composite Mater., Tokyo, 12-14 Jan. 1981 Submitted for publication Prepared in cooperation with Oklahoma Univ.
(Contract N00014-78-C-0647; NR Proj. 064-609)
(AD-A098914; OU-AMNE-81-1; VPI-E-81-11; TR-20) Avail: NTIS HC A03/MF A01 CSCL 11/4

An exact and finite-element analysis is used to predict the static bending and natural vibration response of rectangular plates laminated of composite material having different elastic properties depending upon whether the fiber-direction strains are tensile or compressive. The analysis is based on a theory that accounts for anisotropy, bending stretching coupling, thickness shear deformation, and both coupling inertia and rotatory inertia. The finite-element results are found to agree very closely with the exact closed-form solutions in the case of a cross-ply rectangular plate having simply supported edges and subjected to sinusoidally distributed normal-pressure loading or temperature loading.
Author (GRA)

N81-26188# Pennsylvania State Univ., University Park. Materials Research Lab.
COMPOSITE PYROELECTRIC MATERIALS Final Report, 1 Oct. 1979 - 30 Sep. 1980
R. E. Newnham and A. S. Bhalla 30 Sep. 1980 68 p refs
(Contract MDA903-78-C-0306; ARPA Order 3617)
(AD-A098996) Avail: NTIS HC A04/MF A01 CSCL 07/4

New types of composite materials and various single crystal materials were studied for pyroelectric applications. The pyroelectric figure of merit (p/K) was measured using a fully automated direct (Byre-Roundy) and Chynoweth system built during the past year. Composites of ferroelectric oxides such as PZT, boracites, lead germanate with the polymer spurrs were fabricated. In PZT-Spurrs composites, the pyroelectric figure of merit p/K was improved by a factor of 7 over that of solid PZT. Boracites: Spurrs and Lead Germanate:Spurrs composites possess p/K values equivalent to the figure of merit of their respective single crystalline forms. A new technique was developed to fabricate oriented glass-ceramic pyroelectric targets using large temperature gradients across the glass disk. Pyroelectric figures of merit for recrystallized Li2Si2O5, Ba2Ge2TiO8 and Ba2Si2TiO8 were up to 60% of the single crystal values. Single crystals of antimony sulfur iodide, lithium silicate, lithium germanate, and resorcinol were studied for their potential applications in the pyroelectric devices. SbSI family members have some potentials as oblique-cut targets at low temperatures. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N81-26189 California Univ., Davis.
INTRINSIC DECOMPOSITION OF SODIUM NITRATE AND POTASSIUM NITRATE Ph.D. Thesis
Carolyn Margaret Kramer 1980 275 p
Avail: Univ. Microfilms Order No. 8112005

The decomposition of NaNO3 was studied in air, argon, and vacuum with these experimental techniques: differential scanning calorimetry (DSC), chemical analysis, thermogravimetry and mass spectrometry. Above 840 and 820 K, for NaNO3 and KNO3 respectively, endothermic decomposition reactions were evident in DSC experiments. These decomposition reactions caused the alkalinity to increase and the amount of nitrate increase in the nitrates. A statistical screening technique, in conjunction with chemical analysis, determined that of ten selected variables that cause decomposition, temperature was the most important variable. The presence of carbon dioxide or water vapor, high gas flow rates, and low purity of the salts also enhanced decomposition. Salt samples were decomposed im argon where it was observed that the nitrates decomposed almost entirely to nitrite as low as 624 K, a process which was enhanced by corrosion of the stainless steel containers that were used.
Dissert. Abstr.

N81-26190 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A DATA BASE MANAGEMENT SYSTEM TOWARD AUTOMATED METHODS DEVELOPMENT IN LIQUID CHROMATOGRAPHY Ph.D. Thesis
Michael Kent Starling 1980 433 p
Avail: Univ. Microfilms Order No. 8110477

A multiple run hardware/software system for liquid chromatography was designed and constructed around a dual beam Nunn UV-Vis photodiode array spectrometer. The spectrometer employs Reticon S series diode arrays and holographically ruled concave gratings as dispersive elements. An analog front end performs conversion of raw data into absorbance. The software system incorporates extended user facilities. These include sequence, burst, and scan accumulate data acquisition modes, the use of previous runs as templates for future runs, and a run repeat capability. Data is displayed as it is acquired in real time. Data compression and filtering is allowed through the use of zero data stripping and FFTs, Plotting facilities include plotting of spectra, absorbance band chromatograms, three dimensional hidden line plots of chromatographic data, and the plotting of standard curves. Plots may be directed to CRT or hardcropy graphics output devices. Dissert. Abstr.

N81-26191 Michigan State Univ., East Lansing.
THE CHARACTERIZATION AND APPLICATION OF SOME ELECTROCHEMICAL RELAXATION TECHNIQUES IN CORRELATING INTERPHASIAL STRUCTURE WITH ELECTROCHEMICAL REACTIVITY Ph.D. Thesis
Paul Daniel Tyma 1980 220 p
Avail: Univ. Microfilms Order No. 8112170

The effect on electrochemical redox kinetics of deuterating

both the solvent and ligands of transition-metal complexes was considered. It was shown that ratios of double-layer corrected standard rate constants obtained in the two solvents provide information about difference in the intrinsic free energy barriers to electron transfer which are brought about by solvent deuteration. A pulse-polarographic display format and analysis method applied to a collection of current time transients which result from potential step perturbations of an irreversible electrode reaction were demonstrated to provide more reliable rate information than a chronoamperometric analysis of individual transients. High speed dc polarography was evaluated in terms of its suitability for providing electrochemical change transfer rate information which might be inaccessible by conventional large or small amplitude perturbation techniques. Dissert. Abstr.

N81-26192 Pittsburg Univ., Pa.
KINETIC STUDIES OF REACTIONS OF HYDROXYL RADICALS WITH HALOCARBONS IN THE GAS PHASE Ph.D. Thesis
Kyu-Man Jeong 1980 179 p
Avail: Univ. Microfilms Order No. 8112602

The gas phase reactions of hydroxyl radicals with nine chlorine and fluorine substituted methanes as well as methane itself and four chlorofluoroethanes were studied in a discharge flow system with resonance fluorescence detection. Due to the high sensitivity of this technique, reagent concentrations could be reduced to low levels to minimize secondary reactions. Thus, under pseudo-first order conditions, accurate bimolecular rate constants were obtained as a function of temperature (250 K to 490 K) and the rate data fitted to both the usual Arrhenius expression and a three parameter expression. The latter expression better represented the data in those cases where the Arrhenius plots exhibited curvature. These results are compared with values determined by other recent studies. Dissert. Abstr.

N81-26193 Pittsburg Univ., Pa.
SEMICLASSICAL EXCHANGE SCATTERING THEORY: ANALYSIS OF $He^*(2S-1, 2S-3) + He$ DIFFERENTIAL CROSS SECTIONS Ph.D. Thesis
Roberta Marie Etzel Jordan 1980 153 p
Avail: Univ. Microfilms Order No. 8112604

The lowest collision energy measured was analyzed with a simple theory of direct/exchange scattering. The inversion method was utilized to determine the relevant potential curves at large distances, both including and neglecting van der Waals attraction. The extension of the theory to collision energies thought to be higher than the barrier required modifications in its application. Dissert. Abstr.

N81-26194 Yale Univ., New Haven, Conn.
ELECTROLYTE DIFFUSION IN MULTICOMPONENT SOLUTIONS Ph.D. Thesis
Derek Gordon Leaist 1980 258 p
Avail: Univ. Microfilms Order No. 8110046

Electrolyte solution theory was used to study multicomponent diffusion in mixed electrolyte solutions. Diffusion coefficients were measured conductimetrically at 25 C for dilute electroytes in the following systems: potassium chloride/methanol (40% by weight)/water; hydrochloric acid/methanol (10,20 and 40%) water; and potassium chloride/t-butanol (9.54 and 17.8%) water. The results are correctly described by theory based on pseudo-binary electrolyte diffusion. Diffusion coefficients for dilute hydrochloric acid/potassium chloride were measured at 25 C in a mixed solvent of water and methanol (10% by weight). The results suggested that reliable electrolyte diffusion properties can be predicted from limiting ionic mobilities for any arbitrary ionic mixture at low ionic strength in any arbitrary solvent, as long as the dielectric constant is high enough to give effectively total dissociation. Dissert. Abstr.

N81-26195 Yale Univ., New Haven, Conn.
THE USE OF ELECTROFLUIDIZED BED REACTORS IN THE INVESTIGATION OF THE EFFECTS OF CHARGE ON GAS-SURFACE INTERACTIONS Ph.D. Thesis
Cheng-Guan Michael Quah 1980 364 p
Avail: Univ. Microfilms Order No. 8110058

The hypothesis that electrostatic charge could render an intrinsically inert surface catalytic was investigated using as test reactions: the isomerization of butene, the hydrogeneration of ethylene, and the dehydration or dehydrogeneration of ethanol. In order to maintain the charges on the test solids (glass beads), an electrofluidized bed reactor (EFBR) was designed. A simple model of the phenomenon of electrolevitation provided estimates for the amount of electrostatic charge on the glass beads within the reactor. The extent of chemical reaction was monitored by gas chromatography. Dissert. Abstr.

N81-26196 Houston Univ., Tex.
MODEL STUDIES ON SINGLE PARTICLE CHAR GASIFICATION AND COMBUSTION Ph.D. Thesis
B. Srinivas 1980 230 p
Avail: Univ. Microfilms Order No. 8112878

In the gasification studies, a model for the gasification of a porous char particle in an environment of H2O, H2, CO2, CO and CH4 is developed. The model consisting of the mass and energy balance equations includes the intraparticle effects and the change in internal surface area. It is found that the intraparticle transport and surface area effects are significant and hence cannot be neglected. The model is compared with existing empirical relations. A simple well mixed reactor model is developed to compare the present single particle model with a lumped model. It is found that the lumped model is rather insensitive to the mean residence observed in the distributed system. The difference in the design parameters predicted by the models is large and hence some discrimination in the choice of models is essential. Dissert. Abstr.

N81-26197 Kansas State Univ., Manhattan.
A SINGLE PULSE SHOCK TUBE STUDY OF THE CHEMICAL MECHANISMS OF SOOT FORMATION FROM BENZENE PYROLYSIS Ph.D. Thesis
Stephen Neil Vaughn 1980 206 p
Avail: Univ. Microfilms Order No. 8111831

The thermal decomposition of vapor phase benzene was studied using a single pulse shock tube. The reaction was studied over a temperature range of 1300 to 2300 K with various initial benzene concentrations and reaction times of 0.1 to 3.0 msec. Stable products formed were analyzed by gas chromatography, mass spectrometry, and in the case of solid products by gravimetric determination. Dissert. Abstr.

N81-26198 Brown Univ., Providence, R. I.
A STUDY OF ADSORBED SYSTEMS BY SURFACE REFLECTANCE SPECTROSCOPY Ph.D. Thesis
Graciela Beatriz Blanchet 1980 170 p
Avail: Univ. Microfilms Order No. 8111068

An analysis of surface reflectance spectroscopy data is presented and applied to hydrogen chemisorbed on W(110). This system shows highly anisotropic optical properties that are reflected in the dielectric response. The angular dependence of some features in the dielectric function is predicted for different structural models by calculating the matrix elements using symmetry arguments combined with a simplified tight binding calculation. Comparison with the experimental data determines the symmetry of the adsorbate wavefunctions and shows that the most likely adatom position is in a bridged site. Dissert. Abstr.

N81-26199 Brown Univ., Providence, R. I.
A STUDY OF A FULLY BURNING VERTICAL SURFACE Ph.D. Thesis
Anil Kamalakant Kulkarni 1980 188 p
Avail: Univ. Microfilms Order No. 8111130

Inclusion of the effort of surface radiation is essential to predict extinction. Incomplete combustion is found to strongly affect the predicted extinction limits. The results with the use of a finite chemical reaction rate indicate that for free convection burning of solid fuel the burning rate may be obtained from the much simpler thin flame theory, but for predicting more accurate extinction limits inclusion of a finite rate chemical reaction is necessary. Concerning the extinction mechanisms, it can be concluded that the adiabatic infinite chemical reaction rate case for a free buring vertical surface does not predict extinction. However, the infinite chemical reaction rate assumption with the surface radiation loss gives finite extinction limits. The incompleteness of combustion affects these extinction limits

substantially. The use of a finite chemical reaction rate gives more refined extinction limits which strongly depend on the chemical kinetic parameters chosen. Dissert. Abstr.

N81-26200 Marquette Univ., Milwaukee, Wis.
OXYGEN DISSOCIATION PRESSURE MEASUREMENTS ON NONSTOICHIOMETRIC CERIUM DIOXIDE Ph.D. Thesis
J. William Dawicke 1980 215 p
Avail: Univ. Microfilms Order No. 8111850

A highly sensitive capacitance manometer system useful for determining the deviation from stoichiometry in metal oxides as a function of oxygen partial pressure was constructed, evaluated, and used to determine the oxygen partial pressure dependence of the deviation from stoichiometry in nonstoichiometric cerium dioxide at 800 C. The assumption made in this analysis was that mobility was only a function of temperature. It was found that the mobility was thermally activated which is consistent with a model involving localized electrons and a hopping type conduction mechanism. Dissert. Abstr.

N81-26201 Boston Univ., Mass.
PHOTOCONDUCTIVITY OF LOW DIELECTRIC CONSTANT LIQUIDS: MECHANISM AND APPLICATION TO POLY-CYCLIC AROMATIC SYSTEMS Ph.D. Thesis
Joseph Kennedy Walker, Jr. 1981 198 p
Avail: Univ. Microfilms Order No. 8112226

The kinetics of extrinsic photoconductivity is analyzed for various low dielectric liquid systems. The analysis is based on a theory for pulsed excitation and includes the effects of finite rate of surface quenching of excited molecules, finite rate of detachment of ions from the electrode, and space charge effects due to the flow of the background dark current. For two systems, rubrene in benzene and diphenylanthracene in benzene, the nonuniform electric field arising from the dark current made of major contribution to the observed curve shapes. Inclusion of the field effect makes possible the extraction of the lifetime of the photoconductive state, as well as limits on detachment and quenching rates. The field effect is also shown to affect the quantum yield of charge production. Dissert. Abstr.

N81-26202 Michigan State Univ., East Lansing.
ELECTROCHEMICAL STUDIES OF SOME TRANSITION METAL CRYPTATES AND AN INVESTIGATION OF THE REACTION ENTROPIES OF TRANSITION METAL REDOX COUPLES Ph.D. Thesis
Edmund Lee Yee 1980 251 p
Avail: Univ. Microfilms Order No. 8112180

Electrochemical methods were used to monitor the aqueous complexation and redox chemistry of the trivalent and divalent europium and ytterbium and cryptates. All of these complexes were electrochemically reversible and substitutionally inert on the cyclic-voltammetric time scale. The substantially lower thermodynamic stabilities of the trivalent cryptates (compared to the corresponding divalent complexes) arise from large enthalpic destabilizations which outweigh smaller entropic stabilizations. These differences can be explained in terms of the relative hydration of the uncomplexed trivalent and divalent ions and comply with the trends observed for alkali metal and alkaline earth cryptates having comparable ionic radii. The strong associations of the trivalent Eu and Yb cryptates with hydroxide and fluoride were found to be comparable to those reported for the aquated cations and these anions. Dissert. Abstr.

N81-26203*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ZIRCONIUM CARBIDE AS AN ELECTROCATALYST FOR THE CHROMOUS/CHROMIC REDOX COUPLE Patent Application
Randall F. Gahn, Margaret A. Reid, and Chiang Yuan Yang, inventors (to NASA) Filed 22 May 1981 17 p
(NASA-Case-LEW-13246-1; US-Patent-Appl-SN-266255) Avail: NTIS HC A02/MF A01 CSCL 07D

Zirconium carbide is used as a catalyst in a REDOX cell for the oxidation of chromous ions to chromic ions and for the reduction of chromic ions to chromous ions. The zirconium carbide is coated on an inert electronically conductive electrode which is present in the anode fluid of the cell. NASA

N81-26204# Arizona Univ., Tucson. Dept. of Physics.
A SURVEY OF OPTICAL CONSTANTS IN THE 5 - 25 MICRON SPECTRAL REGION Final Report, 3 Sep. 1979 - 2 Sep. 1980
Donald R. Huffman Apr. 1981 50 p refs
(Contract N00019-79-C-0557)
(AD-A099204) Avail: NTIS HC A03/MF A01 CSCL 07/4

A technique has been developed for determining the spectrum of optical constants in the vicinity of strong lattice absorption bands in the infrared region for solids available only in small particle form. The technique involves segregating a sub-micrometer size fraction of the sample for dispersal in infrared-transparent KBr pellets, measuring the transmission spectrum and fitting it with a combination of the Lorentz oscillator equations and small particle extinction theory, normally based on a random distribution of Rayleigh ellipsoids. The assumption that bulk optical constants apply to particles as small as 0.1 micrometer is supported by careful new measurements on two small particle systems where the shapes are known to be cubes (MgO smoke) and spheres (amorphous quartz smoke). Several tests of the extinction theory for irregular shapes are discussed in cases where optical constants are well known. The method for determining optical constants has been applied to the natural silicate samples obsidian (volcanic glass), serpentine, chlorite, montmorillonite, talc, and volcanic dust from the Mt. St. Helens eruption as well as to amorphous aluminum oxide smoke. The method should be most reliable for single component, isotropic solids existing in a wide distribution of particle shapes. Particular caution is expressed in application to heterogeneous materials such as soil samples and atmospheric dust samples. Author (GRA)

N81-26205# Northwestern Univ., Evanston, Ill. Gas Dynamic Lab.
PRODUCTION AND ELECTRON DIFFRACTION STUDIES OF SILVER METAL CLUSTERS IN THE GAS PHASE
Barry G. DeBoer and Gilbert D. Stein Apr. 1981 11 p refs
(Contract N00014-79-C-0622; NR Proj. 056-729)
(AD-A098872; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Silver is evaporated into an inert gas flowing at pressures between 0.1 and 3 torr and nucleates to form clusters in a size range of 40 to 110 A. This two-phase mixture flows through a two stage molecular beam into a modified electron microscope. Electron diffraction patterns are taken in the cluster beam and analyzed assuming the bulk, face centered cubic unit cell and using a thirteen-beam, multislice, multiple scattering program. Deviations from the bulk structure are seen and are larger for smaller cluster size. Several possible interpretations are discussed. The use of inert molecular gasses as carriers is found to greatly increase cluster production. GRA

N81-26206# New York Univ., N. Y. Dept. of Chemistry.
PHOTOELECTRON EMISSION SPECTROSCOPY OF LIQUID WATER
Paul Delahay and Kathrin vonBurg Apr. 1981 21 p refs Submitted for publication
(Contract N00014-75-C-0397; NR Proj. 051-258)
(AD-A099202; TR-15) Avail: NTIS HC A02/MF A01 CSCL 07/4

The threshold energy Et = 10.06 eV (0.002 eV standard deviation) is determined for photoelectron emission by liquid water and is correlated with Et = 8.45 eV for OH-(aq). Free energy changes and standard reduction potentials are calculated for both emission processes. Reorganization free energies are correlated to solvation free energies for H2O+(aq) and OH-(aq).
Author (GRA)

N81-26207# Northwestern Univ., Evanston, Ill. Dept. of Mechanical and Nuclear Engineering.
CREATION AND STRUCTURE STUDY OF VACUUM ISOLATED CLUSTERS OF ARGON, KRYPTON AND XENON Interim Report
Sang Soo Kim and Gilbert D. Stein Apr. 1981 28 p Submitted for publication
(Contract N00014-79-C-0622; NR Proj. 056-729)
(AD-A098871; TR-4) Avail: NTIS HC A03/MF A01CSCL 07/4

Homogeneous clusters of Ar, Kr or Xe are formed in adiabatic, high Mach number expansions through very small, diverging Laval nozzle sources. A He carrier gas is employed and the mole

fraction of condensable species varied from 1.0 to 0.06 in an effort to control the cluster size distribution and temperature. The nozzle source is part of a multi-stage molecular beam apparatus. Electron diffraction, using a 40 keV beam, is used to study cluster structure. Cluster sizes are varied from g-bar = 50 to 1,500 atoms per cluster and temperatures range from 20 to 60 K. The structure for g-bar = 1,000 is bulk f.c.c. and transforms gradually into a non-crystalline structure as size decreases. The smallest structures, for all three noble gases, are consistent with the icosahedral structures which are theoretically favored energetically in this regime. For a fixed mole fraction of 0.06, the cluster temperature, T sub c, are systematically higher going from Ar to Xe with dimensionless temperatures, kTc/epsilon, systematically lower. There is evidence that P sub 0 D sub 0/(kT sub 0/epsilon) is the unifying parameter for predicting the onset of massive clustering for rare gases in these nozzle-type sources. Author (GRA)

N81-26208# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.

DETERMINATION OF ALCOHOLS IN ENGINE LUBRICANTS Interim Report.

Frank M. Newman and Kenneth B. Jones Jan. 1981 25 p refs Presented at a Meeting of the Gulf Coast Instrumental Analysis Group, Houston, Tex., 30 Apr. 1981 Sponsored in part by DOE

(Contract DAAK70-79-C-0175; E(49-28)-1021)

(AD-A099038; AFLRL-135) Avail: NTIS HC A02/MF A01 CSCL 21/4

The recent interest in alcohol and alcohol-containing fuels in spark ignition engines requires new information and analytical methods concerning the presence of alcohols in used lubricants. AFLRL has developed a straightforward, rapid, and accurate method to determine and measure the alcohols. The oil and alcohols are separated using an adsorber or stripper column, and then the alcohols are resolved on the second column in series and determined with a flame ionization detector. Quantitative standards were prepared to include the normally expected range of alcohol content of 0-10 percent. The use of a second alcohol as an internal standard helps offset the reproducibility error involved in the syringe technique. The standard is completed by adding approximately 50 vol% of CS2. It is suggested that the alcohol chosen as the internal standard be at least 2 carbon numbers higher or lower than the analyte to help enhance the peak resolution and integration. The samples are prepared in much the same manner as the calibration standards, with 1 to 5 percent of the alcohol chosen to be the internal standard added. GRA

N81-26209# SRI International Corp., Menlo Park, Calif.

ANALYSIS OF MIDDLE DISTILLATE FUELS BY FIELD IONIZATION MASS SPECTROMETRY Interim Technical Report, 7 Sep. 1979 - 9 Sep. 1980

S. E. Buttrill, Jr. Sep. 1980 48 p

(Contract N00173-79-C-0462; SRI Proj. PYU-8903)

(AD-A099407) Avail: NTIS HC A03/MF A01 CSCL 21/4

This interim technical report describes work completed during the first twelve months of a research program to develop field ionization mass spectrometry for quantitative analyses of middle distillate fuels. The relative field ionization sensitivities were measured for 90 compounds from petroleum, shale, or coal. The FIMS sensitivities for naphthalenes are from 2 to 3 times greater than for saturates, an advantage for detecting these minor components. Sensitivity was also high for nitrogen and sulfur containing compounds which will increase the level at which these materials may be detected in fuels. Distillation of the fuel sample from a solids probe into the FIMS source was found to not provide sufficient separation of compounds such as naphthalenes and saturates. These compounds will be separated using high resolution FIMS. The precision of the proposed analysis method was evaluated with an authentic jet fuel sample, and it was found that the coefficient of variation of minor components averaged 6 percent while that of larger components was 2 or 3 percent. The use of high resolution FIMS together with a batch inlet system and computerized data collection and analysis system appears to be a highly promising technique for providing detailed quantitative data on the chemical composition of middle distillate fuels. Author (GRA)

N81-26210# State Univ. of New York at Buffalo. Dept. of Chemistry.

ELECTROCHEMICAL BEHAVIOR OF SULFIDE AT THE SILVER ROTATING DISC ELECTRODES. 1: POLARIZATION BEHAVIOR OF SILVER SULFIDE FILMS

Kunio Shimizu, Aoki Koichi, and Robert A. Osteryoung May 1981 43 p refs Submitted for publication 2 Vol.

(Contract N00014-79-C-0682)

(AD-A099214; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07/4

A rotating silver disc electrode in a sodium hydroxide solution containing sodium sulfide was used to study the anodic polarization, passivation, and cathodic polarization of silver sulfide films on the silver disc electrode. Anodic limiting currents are controlled by convective diffusion of sulfide ions at potentials more anodic than the equilibrium potential for silver sulfide/sulfide ion. The anodic depolarization of silver by sulfide is diffusion limited until the deposited film develops an appreciable thickness. All silver sulfide produced during anodic polarization is quantitatively reduced to silver during a cathodic potential scan. Author (GRA)

N81-26211# State Univ. of New York at Buffalo. Dept. of Chemistry.

ELECTROCHEMICAL BEHAVIOR OF SULFIDE AT THE SILVER ROTATING DISC ELECTRODE. 2: MECHANISM OF SILVER FILM FORMATION

Koichi Aoki, Kunio Shimizu, and Robert A. Osteryoung May 1981 32 p refs Submitted for publication 2 Vol.

(Contract N00014-79-C-0682)

(AD-A099226; TR-5) Avail: NTIS HC A03/MF A01 CSCL 07/4

Steady state anodic voltammograms were measured at a silver rotating disc electrode in a basic sulfide solution. Analysis of the voltammograms indicates that the rate determining steps in the dissolution of silver are due to a combination of surface chemical reaction, forming silver sulfide, and the charge transfer-reaction between silver and silver ion. Kinetic parameters of each step are evaluated and an I-E curve is reproduced from these parameters. The wave form is in good agreement with the voltammogram obtained experimentally. Author (GRA)

N81-26212# Duquesne Univ., Pittsburgh, Pa. Dept. of Chemistry.

HYDROGEN BONDING IN ASPHALTENES AND COAL LIQUIDS Quarterly Report, 1 Feb. - 30 Apr. 1981

N. C. Li, L. Jones, and N. F. Yaggi 1981 30 p refs

(Contract DE-AC22-80PC-30252)

(DOE/PC-30252/T3; QR-3) Avail: NTIS HC A03/MF A01

The nature and strength of hydrogen bonding and other molecular interactions in coal liquids and their fractions are investigated. Determinations are made of the molecular interactions involving the preasphaltene, asphaltent and oil, together with their separated fractions, obtained from coal liquids after hydroprocessing under different processing conditions and accelerated aging. The upgraded coal liquids, derived from catalytic hydroprocessing of a 30 to 70 weight percent blend of solid solvent refined coal product (SRC-1) with liquid solvent-refined coal product (SRC-2) were analyzed as a function of contact time and temperature, and the observed variations of structural parameters were correlated with the physical properties of the liquid products. DOE

N81-26213# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

INITIATION OF DEGRADATION IN POLYCRYSTALLINE SODIUM BETA ALUMINA ELECTROLYTES

Lutgard C. DeJonghe, L. Feldman, and A. Buechele May 1980 6 p refs Presented at the 3d Intern. Meeting on Solid Electrolytes, Tokyo, 15-19 Sep. 1980; sponsored by the Japan Society for the Promotion of Science and the DOE Submitted for publication

(Contract W-7405-eng-48)

(LBL-11000; CONF-8009134-1) Avail: NTIS HC A02/MF A01

Sodium beta alumina solid electrolytes degrade during use in sodium sulfur cells. The degradation can take two forms: Mode I degradation involving the rapid propagation of macroscopic

cracks driven by cathodic deposition of sodium in them; and Mode II degradation involving a slow degradation due to electron injection from the Na/beta alumina contact. The initiation stage of Mode I is the most important one since cracks propagate rapidly once they are formed. The significance of the local microstructure on the Mode I initiation is discussed. It appears that grain boundaries can be favorable sites for Mode I failure initiation. DOE

N81-26214# California Univ., Berkeley. Lawrence Berkeley Lab.
FLUOROSULFATES OF GRAPHITE AND BORON NITRIDE AND OTHER HIGH OXIDATION STATE STUDIES
R. N. Biagioni Oct. 1980 135 p refs
(Contract W-7405-eng-48)
(LBL-11760) Avail: NTIS HC A07/MF A01

The adduct XeF2.AsF5 was re-examined and assessed to be intermediate between the salt formulation (FXe)(+)AsF6(-) and the fluorine bridged molecular adduct. A series of graphite fluorosulfates were prepared, using as the oxidizing agent S2O6F2, and the effects of incorporating varying amounts of fluorosulfonic acid were studied. Physical data indicated that the S2O52 was incorported as SO3F(-), and the HSO3F was bound tightly, probably due to hydrogen bonding. The c-spacings of HSO3F containing materials were larger than those of acid free materials, and the influences of charging, guest size, and guest orientation were examined. X-ray diffractometer studies of graphite slabs intercalated with SO3F/HSO3F and IrF6 indicated structures consistent with the characterization of these materials as containing tetrahedral SO3F and octahedral IrF6. Boron nitride reacted with S2O6F2 to yield a deep blue, conducting intercalation compound. DOE

N81-26215# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY RESULTS OF THERMAL IGNITER EXPERIMENTS IN H SUB 2-AIR-STEAM ENVIRONMENTS
William Lowry Jan. 1981 32 p refs Presented at the Workshop on the Impact of Hydrogen on Water Reactor Safety, Albuquerque, N. Mex., 25-28 Jan. 1981
(Contract W-7405-eng-48)
(UCRL-84167-Rev-1; CONF-810120-3-Rev-1) Avail: NTIS HC A03/MF A01

Thermal igniters (glow plug), proposed by the Tennessee Valley Authority for intentional ignition of hydrogen in nuclear reactor containment, used for functionability in mixtures of air, hydrogen, and steam. Test environments included 6% to 16% hydrogen concentrations in air, and 8%, 10%, and 12% hydrogen in mixtures with 30% and 40% steam fractions. All were conducted in a 10.6 cu ft insulated pressure vessel. For all of these tests the glow plug successfully initiated combustion. Dry air/hydrogen tests exhibited a distinct tendency for complete combustion at hydrogen concentrations between 8% and 9%. Steam suppressed both peak pressure and completeness of combustion. No combustion could be initiated at or above a 50% steam fraction. Circulation of the mixture with a fan increased the completeness of combustion. The glow plug showed no evidence of performance degradation throughout the program. DOE

N81-26216# Battelle Pacific Northwest Labs., Richland, Wash.
THERMAL DEGRADATION OF CELLULOSE IN ALKALI
Rachel K. Miller, Peter M. Molton, and Janet A. Russell Dec. 1980 12 p refs Presented at the 3d Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 15 Dec. 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8603; CONF-801210-21) Avail: NTIS HC A02/MF A01

Biomass in an alkaline aqueous slurry can be liquefied by heat and pressure. Understanding the mechanisms of biomass liquefaction to improve the efficiency of converting biomass to useful product, particularly chemicals and synthetic fuels is discussed. To study the chemical mechanisms of the process, pure cellulose, the main component of biomass, was liquefied. The 78 cellulose liquefaction products that were identified by gas chromatography/mass spectrometry include polyols, furans, ketones, hydrocarbons, and aromatic compounds. Polyols may be formed by hydrogenolytic cleavage. Furans and cyclic ketones may be cyclization products of dicarbonyl intermediates formed by aldol condensation of small initial degradation products such as acetone and acrolein. For the best case of 26 cellulose liquefaction experiments, 34% of the initial mass of the cellulose was converted to acetone-soluble oil with a heat of combustion of 14,000 Btu/lb. DOE

N81-26217# Los Alamos Scientific Lab., N. Mex.
DYNAMIC MATERIAL PROPERTY MEASUREMENTS USING AN IMPROVEMENT OF THE FREELY EXPANDING RING TECHNIQUE
T. A. Duffey, R. R. Karpp, R. H. Warnes, J. D. Jacobson, and A. E. Carden 1981 6 p refs Presented at Soc. for Exptl. Stress Analysis Speakers Meeting, Dearborn, Mich., 31 May - 5 Jun. 1981
(Contract W-7405-eng-36)
(LA-UR-81-623; CONF-810507-1) Avail: NTIS HC A02/MF A01

Improvements to the expanding ring test for determination of dynamic material properties are described. The improvements alleviate previous difficulties associated with double differentiation of ring displacement time data. The technqiue is illustrated utilizing 6061-0 and 6061-T6 aluminum rings expanded well into the plastic range at strain rates up to 10,000/s. Two dimensional numerical investigations of the expansion process qualitatively predict observed results and clarify the range over which data is useful for determining material properties. DOE

N81-26218# Pennsylvania State Univ., University Park. Materials Research Lab.
HYDROGEN AND CHLORINE DETECTION AT THE SiO2/Si INTERFACE
I. S. T. Tsong, M. D. Monkowski, J. R. Monkowski, A. L. Wintenberg, P. D. Miller, and C. D. Moak 1981 16 p refs Presented at the 5th Intern. Conf. on Ion Beam Analysis, Sydney, 16 Feb. 1981 Prepared jointly with Oak Ridge National Lab., Tenn.
(Contracts DAAG29-80-K-0085; W-7405-eng-26; Grant NSF DMR-78-09767)
(CONF-810231-1) Avail: NTIS HC A02/MF A01

Hydrogen and chlorine depth profiles were obtained on a series of silicon oxides thermally grown in HCl/O2 and Cl2/O2 ambients at 1100 C for 15 minutes using the F-19 nuclear reaction and SIMS techniques. The data show close correlation between the H and Cl profiles in both the HCl/O2 and Cl2/O2 oxides. While the H and Cl appear to be enriched at the SiO2/Si interface of the HCl/O2 oxides, they are higher in concentration and more evenly distributed in the oxide bulk of the Cl2/O2 oxides. DOE

N81-26219# Ames Lab., Iowa. Dept. of Chemistry.
SYNTHESIS AND REACTIVITY OF SOME TUNGSTEN CARBENE COMPLEXES Ph.D. Thesis
Ruth A. Pickering Feb. 1981 125 p refs
(Contract W-7405-eng-82)
(IS-T-945) Avail: NTIS HC A06/MF A01

Dithiocarbene tungsten complexes were prepared in good yield. The substituted tetracarbonyl dimethyldithiocarbene tungsten complexes are prepared by an analogous route. Cyclic dithiocarbene tungsten complexes may be prepared in a similar manner. Net effect of the reaction of tungsten dithiocarbene complexes with tertiary phosphine is to transfer the carbene group from the tungsten to the phosphorus atom. DOE

N81-26220# Pennsylvania State Univ., University Park. Dept. of Chemistry.
MONTE CARLO SIMULATION OF ISOTOPE SEPARATION IN OPPOSED JETS
J. B. Anderson and G. F. Malling (Union Carbide Corp., Oak Ridge, Tenn.) 30 Mar. 1981 14 p refs Presented at the 12th Intern. Symp. of Rarefied Gas Dyn., Charlottesville, Va., 7-11 Jul. 1980
(Contract W-7405-eng-26)
(K/OA-4726; CONF-800715-5) Avail: NTIS HC A02/MF A01

The separation of isotopes in opposed jet flows from slits was examined in Monte Carlo simulations of these flows at several density levels. The basic Monte Carlo method was

employed to determine the flow fields and provide preliminary estimates of separation factors. Separation factors of high accuracy were obtained using a test-particle method in which single particles were followed through the flow fields established by the Bird method. Species densities, velocities and velocity distributions, as well as separation factors, are reported. DOE

N81-26221# Argonne National Lab., Ill.
AMPEL EXPERIMENTS: NITRIC-OXIDE CONCENTRATION MEASUREMENTS IN A SIMULATED MHD COMBUSTION GAS
P. F. Dunn, T. R. Johnson, and C. B. Reed Dec. 1980 91 p refs
(Contract W-31-109-eng-38)
(ANL/MHD-80/13) Avail: NTIS HC A05/MF A01

Results are presented of recent investigations of the effect of secondary combustion on nitric oxide (NO) concentrations in simulated magnetohydrodynamic (MHD) combustion gas. Forty-one experiments, in which NO concentration measurements were made, were conducted at the Argonne MHD Process Engineering Laboratory (AMPEL). In sixteen of those experiments, secondary air mixed with the primary combustion gas was combusted over two temperature ranges. For all clean-fuel experiments conducted, the measured changes in NO concentration that resulted from secondary combustion were predicted to within 10%, using an Argonne modification of the NASA chemical kinetics code. This predictive code was extended to estimate changes in NO concentrations that would occur during secondary combustion in a larger MHD facility. It is concluded that, in addition to mixing and several other factors, the heat loss from the secondary combustion zone strongly influences the amount of NO formed during secondary combustion. DOE

N81-26222# National Bureau of Standards, Washington, D.C. Center for Fire Research.
FLAMMABILITY TESTING OF SOLIDS UNDER THE FEDERAL HAZARDOUS SUBSTANCE ACT Final Report, 1974 - 1975
Richard D. Peacock and Marianne P. Vaishnav Apr. 1980 93 p refs Revised
(PB80-226632; NBSIR-78-1580) Avail: NTIS HC A05/MF A01 CSCL 13L

A program to provide improvements to particular provisions of the Act is described, including test methods used for the testing of various solid materials. An extensive review of the Federal Hazardous Substances Act, its prodecessor, and the legislative history provides the basis for some specific recommendations for improvement or clarification. Experimental work performed for the improvement of test methods for shredded or slit films, powders, pastes, and granular substances, and for extremely flammable solids is discussed. GRA

N81-26223# Notre Dame Univ., Ind. Radiation Lab.
A CATALOG OF DATA COMPILATIONS ON PHOTOCHEMICAL AND PHOTOPHYSICAL PROCESSES IN SOLUTION
James G. Brummer, W. Phillip Helman, and Alberta B. Ross Washington NBS Nov. 1980 27 p Sponsored by NBS and DOE
(PB81-167025; NBS-SP-578; LC-80-600117)
Avail: NTIS HC A03/MF A01 CSCL 07D

References to compilations and reviews of data on photochemical and photophysical processes in solution are annotated to indicate subject and data content. Indexes are included for data types, keywords, and authors. GRA

N81-26224# Illinois Univ. at Urbana-Champaign. Water Resources Center.
HUMIC SUBSTANCES REMOVAL BY ACTIVATED CARBON Final Project Report
Michael C.-Y. Lee and Vernon L. Snoeyink Nov. 1980 137 p refs
(Contract DI-14-34-0001-8083)
(PB81-163552; UILU-WRC-80-0153; W81-01491; OWRT-B-110-ILL(1)) Avail: NTIS HC A07/MF A01 CSCL 07D

A humic acid and a fulvic acid were used to evaluate the removal of humic substances by various activated carbons. Different analytical methods were investigated to measure the concentration of humic substances and their chloroform potential. Total organic carbon measurement and ultraviolet/visible adsorbance correlate well with the chloroform potential of humic substances. Pore size distribution was the most important physical characteristic of activated carbon for adsorption of humic substances. A decrease of pH in solution, lower molecular weight fractions of humic substances, smaller carbon particles, and the presence of soluble alum were found to increase carbon adsorption. Chemical pretreatment with alum increased the adsorption capacity of carbon almost three-fold. GRA

N81-26225# Bend Research, Inc., Oreg.
DEVELOPMENT OF COMPOSITE HOLLOW FIBERS, PHASE 2 Final Report
W. C. Babcock, R. W. Baker, R. P. Barss, G. C. Corson, B. A. Kruse-Smith, and H. K. Lonsdale 15 Sep. 1980 36 p refs
(Contract DI-14-34-0001-9521)
(PB81-161010; W81-01465; OWRT-C-90261-D(9521)(1))
Avail: NTIS HC A03/MF A01 CSCL 07D

The results of a program to develop inside skinned, composite hollow fibers for brackish water desalination by reverse osmosis are described. Minor improvements were made in the polysulfone fibers and a procedure was developed for reliably coating the lumen surfaces of the fibers with an NS-100 membrane. Modules containing several hundred fibers and having a combined membrane area of 1 sq ft. exhibited rejections in excess of 90 percent and fluxes of 5 to 20 gfd at 400 psi with 0.5 wt percent NaCl. The best module performance was 98.1 percent NaCl rejection and a flux of 13.4 gfd. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-26226 North Carolina State Univ. at Raleigh.
AN EXPERIMENTAL STUDY OF THE WELDABILITY OF HIGH STRENGTH LOW ALLOY STEEL Ph.D. Thesis
Jonny Lee Elliott 1980 88 p
Avail: Univ. Microfilms Order No. 8111026

The effects of varying energy input (KJ/in) on the mechanical properties of SA516 Gr.70 carbon steel plate were studied. The welding process was an automatic flux cored arc welding (FCAW) procedure using the ASME 3G (vertical) position. The number of variables which could potentially affect the mechanical properties were limited by using test sample plate materials of the same heat; same welding equipment, process, position, and welder; and the same mechanical testing equipment. The change in welding behavior due to the energy input variations was evaluated utilizing the following tests: tensile; bend; hardness; charpy impact; and microstructure inspections. The SA516 Gr.70 material as modified showed good weldability even with a wide range of energy input as long as good welding practice was followed. Dissert. Abstr.

N81-26227 Pittsburg Univ., Pa.
HOT CORROSION OF COBALT-BASE ALLOYS Ph.D. Thesis
Kuang-Tsan Chang 1980 196 p
Avail: Univ. Microfilms Order No. 8112587

The influence of alloy composition, salt composition and temperature on the hot corrosion process was investigated. The effect of SO3 pressure and NaCl vapor in the gas phase on Na2SO4 induced hot corrosion was studied in the low temperature range 700-750 C. The alloys Co-27Cr and Co-18Cr-6Al were chosen to be representative of Cr2O3 and Al2O3 forming alloys for this study. A Ni-20Cr alloy was also included for comparison. The degradation of the Na2SO4 coated Co-Cr and Ni-Cr alloys in SO3 pressures of 10 to the minus 4th power to 10 to the minus 2nd power atmospheres was found to be associated with the formation of liquid mixed sulfates (Na2SO4-CoSO4 or Na2SO4-NiSO4) which provided a selective dissolution of the Co or Ni and a subsequent sulfidation/oxidation mode of attack which prevented the maintenance of a protective Cr2O3 film. A clear mechanism was not developed for the degradation of Co-Cr-Al alloys. The sulfite model proposed by Pettit and

coworkers or a modification of the sulfidation/oxidation mechanism are both capable of explaining the experimental results.
Dissert. Abstr.

N81-26228 Pittsburg Univ., Pa.
A HOT WORKABILITY TESTING SYSTEM AND ITS APPLICATION TO SOME FCC ALLOYS Ph.D. Thesis
Guillermo Luis Fitzsimons 1980 252 p
Avail: Univ. Microfilms Order No. 8112698

A hot workability testing apparatus was designed and constructed. The system is composed of four major elements (1) a closed loop servo controlled hydraulic machine with programmable and custom-made control components; (2) high temperature tooling and radiant heating furnace for isothermal test conditions; (3) a test specimen transfer device for ease of testing and rapid quenching; (4) computerized data acquisition and reduction system. Isothermal compression tests are performed for flow stress determination, as well as upset and bend tests for workability evaluation. Test temperature to 1200 C may be achieved, along with constant strain rates up to 20 sec (-1) for both compression and bend tests. Maximum force is 160 kN. Specimens can be quenched within 0.5 sec. to permit the study of the microstructure developed during hot deformation. In both compression and bending, interrupted deformation schedules can be programmed. Change of rate tests to measure strain rate sensitivities are also possible. Dissert. Abstr.

N81-26229 California Univ., Davis.
SUPERPLASTIC DEFORMATION OF A PM NICKEL BASE SUPERALLOY Ph.D. Thesis
Shri Krishna Srivastava 1980 180 p
Avail: Univ. Microfilms Order No. 8112024

Superplastic deformation behavior of powder metallurgically processed IN-100 (Ni alloy with Cr, Co, Mo, Al and Ti as basic components) was studied at temperatures from 1203 K to 1278 K. Mechanical and thermoactivation parameters were determined by constant strain rate ,tension tests and by stress relaxation tests. Strain rate sensitivity (m) in tension tests is approximately 0.5 at all test temperatures and is shown to be independent of strain except at the lowest test temperature. Good correlation is obtained between stress-strain rate relationship from tension test and stress relaxation test. Metallographic observations revealed the absence of any grain boundary carbides in the as received material and considerable particle coarsening in the deformed specimens. Models for superplastic deformation are compared with the experimental data and it is concluded that activation energy corresponds to diffusion accommodated sliding accompanied with particle coarsening. Dissert. Abstr.

N81-26230 Illinois Inst. of Tech., Chicago.
TEMPER EMBRITTLEMENT AND COLD WORK EFFECTS IN 6130 STEEL Ph.D. Thesis
Roch Joseph Shipley 1980 182 p
Avail: Univ. Microfilms Order No. 8112427

The study investigated the possibility that mechanical treatment of temper embrittled 5130 steel could enhance de-embrittlement during subsequent retempering. It was found that it was not necessary to postulate a de-embrittlement mechanism to account for the effects of cold work on toughness. Anisotropy in toughness was developed by cold drawing. This was studied in several ways. Instrumented impact tests of precracked Charpy specimens were most significant. Short rod fracture tests were used to assess toughness in the longitudinal direction. Anisotropy was also related to the preferred crystallographic orientation developed by cold deformation. Cold work had deleterious effects upon grain boundaries, especially when the interfaces were already embrittled. Dissert. Abstr.

N81-26231 Cornell Univ., Ithaca, N. Y.
EFFECT OF TRAPPING ON HYDROGEN AND DEUTERIUM TRANSPORT IN IRON AND STEEL Ph.D. Thesis
Ruey-Way Lin 1981 182 p
Avail: Univ. Microfilms Order No. 8110898

Hydrogen and deuterium permeation through annealed and cold worked iron was studied. Gas phase charging coupled with electrochemical technique was used to detect hydrogen flux over 278 - 343 K. Valid and reproducible results were obtained for specimens with input surface coated with thin Pd or Ni films. Ni coated specimens were more susceptible to surface contamination. Hydrogen and deuterium exhibited the same trapping behavior in iron. Trapping parameters with binding energy of 51.8 plus or minus 4.2 kJ/mole and trap density of 10 to the 21st power /cu m were derived from time lag measurement for annealed iron. Trap density was shown to increase with deformation level. A method of transient analysis using the McNabb and Foster model coupled with a numerical analysis technique was developed. The trapping parameters derived strongly support the result of the time lag analysis, i.e., a deep trapping state exists in iron.
Dissert. Abstr.

N81-26232 Brown Univ., Providence, R. I.
VOID NUCLEATION IN SPHEROIDIZED STEELS DURING TENSILE DEFORMATION Ph.D. Thesis
John Robb Fisher, Jr. 1980 193 p refs
Avail: Univ. Microfilms Order No. 8111100

An investigation was conducted to determine the effects of various mechanical and material parameters on void formation at cementite particles in axisymmetric tensile specimens of spheroidized plain carbon steels. Desired microstructures for each of three steel types were obtained by controlled tempering of quenched rods, resulting in various particle size distributions. Cylindrical tensile specimens were then strained to prescribed reductions in neck area corresponding to deformation levels near fracture. Observations of void morphology with respect to various microstructural features were made using optical and scanning electron microscopy. While it was noted that nonequiaxed, irregularly shaped particles often failed by internal fracture, spheroidal particles were observed to form voids by decohesion of the particle matrix interface in the vicinity of the particle poles. Large particles were favored sites for void nucleation as were particles situated on ferrite grain boundaries. Dissert. Abstr.

N81-26233 Cornell Univ., Ithaca, N. Y.
IMPREGNATED NICKEL ON GAMMA-ALUMINA CATALYST: CATALYST DESIGN AND CHARACTERIZATION Ph.D. Thesis
Masaharu Komiyama 1981 131 p
Avail: Univ. Microfilms Order No. 8110875

A model was developed for the time-dependent flow of impregnating solution into a dry pellet and internal dispersal of impregnant. Depending on the impregnation parameters, surface impregnation, a uniform impregnation, a subsurface impregnation, or the deposition of a subsurface band of nickel with the core of the sphere devoid of nickel resulted. The model was consistent with actual impregnation profiles, both for single component and two component pH controlled systems. Nickel concentrations were measured by light transmission through a thin section of the reduced catalyst and by an electron microprobe. The size distribution of nickel crystallites dispersed on gamma alumina and its sintering behavior were examined. The size of the nickel crystallites was found to be almost uniform (2 to 3 nm in diameter) in fresh catalysts despite the difference in the mode of deposition and four-fold change in loading. This distribution was also relatively sintering resistant. Dissert. Abstr.

N81-26234*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH TEMPERATURE CYCLIC OXIDATION FURNACE TESTING AT NASA LEWIS RESEARCH CENTER
Charles A. Barrett and Carl E. Lowell 1981 15 p refs Presented at the Symp. on Ind. Methods for Testing at High Temp. Environ., Phoenix, Ariz., 12 May 1981; sponsored by American Society for Testing and Materials
(NASA-TM-81773; E833) Avail: NTIS HC A02/MF A01 CSCL 11F

A standardized method of testing the cyclic oxidation resistance of various alloys in static air to 1200 C was developed and is routinely used at NASA Lewis Research Center. Test samples are automatically raised and lowered into a resistance wound furnace for a series of fixed interval heating and cooling cycles. Spall catchers collect the accumulated spall from each sample. The samples are weighed intermittently to generate specific weight change/time data. At various test times the samples and the accumulated spall are analyzed by X-ray diffraction. A computer program uses this gravimetric and X-ray data as input to print out the oxidation curves and specific

weight change/time and X-ray results in a published format, organizes, and indexes the data. So far, several hundred Fe, Ni, and Co base alloys were tested using this same basic procedure and results form the basis of a series of cyclic oxidation handbooks to be published by NASA. Such specific weight change/time data were used to estimate the oxidative metal consumption by several computer modeling techniques to rank alloys and for use in life testing estimates. A.R.H.

N81-26235*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FRETTING WEAR AND FRETTING FATIGUE: HOW ARE THEY RELATED?

Robert C. Bill 1981 25 p refs Proposed for presentation at the Joint Lubrication Conf., New Orleans, 4-7 Oct. 1981; sponsored by American Society of Lubrication Engineer and ASME Prepared in cooperation with Army Aviation Research and Development Command, Cleveland, Ohio

(NASA-TM-82633; AVRADCOM-TR-81-C-16; E-715) Avail: NTIS HC A02/MF A01 CSCL 11F

Results from published literature, and results obtained experimentally using a fretting wear apparatus are examined to determine how fretting wear and fretting fatigue are related. The effects of various experimental parameters including slip amplitude, number of fretting cycles, frequency of fretting motion, experimental atmosphere, temperature, and the performance of coatings and surface treatments are surveyed. All of the results examined indicate that fretting wear and fretting fatigue are influenced in a consistent and analogous manner by controlled variations in experimental conditions. That is, conditions that tend to accelerate fretting wear also accelerate fretting fatigue failures. Correlation of the performance of coatings on material under fretting wear and fretting fatigue conditions is rather tenuous, partly because similar contact conditions for fretting fatigue and fretting wear are not available for very many materials. A.R.H.

N81-26236*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HOSTILE ENVIRONMENTAL CONDITIONS FACING CANDIDATE ALLOYS FOR THE AUTOMOTIVE STIRLING ENGINE

Joseph R. Stephens 1981 12 p refs Proposed for presentation at the Environ. Degradation of Eng. Mater. Conf., Blackburn, Va., 21-23 Sep. 1981

(Contract DE-AI01-77CS-51040)

(NASA-TM-82632; DOE/NASA/51040-29; E-887) Avail: NTIS HC A02/MF A01 CSCL 11F

The materials research program in support of the Automotive Stirling Engine Project focuses on the hot heater head of the engine including the heater head tubes, cylinders, and regenerator housings, which are considered to be the most critical components from a materials viewpoint. The specific areas of investigation in the program involve hydrogen permeability testing, doping of the hydrogen working fluid to reduce permeability rates, oxidation/corrosion studies, creep-rupture evaluation, and assessing effects of hydrogen environment on mechanical properties. Emphasis is placed on the materials challenges that result from the use of hydrogen as the working fluid. S.F.

N81-26237# Illinois Univ. at Urbana-Champaign. Dept. of Metallurgy and Mining Engineering.

HYDROGEN EFFECTS ON THE FRACTURE OF BCC METALS

H. K. Birnbaum Mar. 1981 19 p refs

(Contract N00014-75-C-1012)

(AD-A099050) Avail: NTIS HC A02/MF A01 CSCL 11/6

The effects of hydrogen on the fracture of BCC metals are reviewed. Author (GRA)

N81-26238# Illinois Univ. at Urbana. Dept. of Metallurgy and Mining Engineering.

THE EFFECT OF HYDROGEN ON THE FRACTURE AND SLIP BEHAVIOR OF NICKEL

Frank Heubaum and H. K. Birnbaum Mar. 1981 73 p refs

(Contract N00014-75-C-1012)

(AD-A099158) Avail: NTIS HC A04/MF A01 CSCL 11/6

The introduction of hydrogen into nickel specimens by thermal charging leads to a predominantly intergranular failure mode regardless of sulfur segregation to grain boundaries. Following significant plastic deformation, crack nucleation occurs at grain boundary triple points and along grain boundaries situated within a stress concentration region. Large COD's are generated during crack growth through localized plastic deformation at the crack tip and intense grain boundary shearing. Grain boundary fracture facets show clear indications of such deformation in the form of slip with occasional cracking along slip lines. Secondary cracking at triple points ahead of the main crack is a common occurrence. Transgranular fracture is observed in specimens having no significant sulfur segregation at grain boundaries when strained in H2 gas. Two surface X-ray analysis in Ni single crystals show this fracture plane to be of the (111) type. This type of failure is also accompanied by considerable plastic deformation both prior to crack initiation and during crack growth. The fracture surface markings show evidence of this ductile failure with clear slip lines and tetrahedral hillocks whose faces appear to correspond to intersecting (111) planes. GRA

N81-26239# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.

CREEP-FATIGUE ENVIRONMENT INTERACTIONS IN SUPERALLOYS Final Report, 1 Dec. 1975 - 1 Nov. 1980

Regis M. Pelloux 15 Apr. 1981 36 p refs

(Grant AF-AFOSR-2928-76; AF Proj. 2306)

(AD-A098790; AFOSR-81-0450TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The fatigue-creep-environment interactions in nickel base superalloys were investigated from 650 to 760 C in the low cycle fatigue range and in the crack growth mode as a function alloy chemistry and microstructure. Three alloys, conventionally cast and forged Waspaloy, powder metallurgy as-hot isostatically pressed low carbon Astroloy, and powder metallurgy superplastically forged IN-100 were compared by room and elevated temperature low cycle fatigue testing under control of total strain range. It was found that at 427 C and 649 C Waspaloy had the longest fatigue lifetimes followed by low carbon Astroloy, then IN-100, but IN-100 had the highest cyclic flow stress and Waspaloy the lowest. On the basis of its relatively good combination of fatigue properties, homogenity and isotropy resulting from powder processing, and because it can be heat treated to a wide variety of different microstructures, one alloy, low carbon Astroloy was selected for a program to systematically determine the effects of changes in microstructure on elevated temperature fatigue behavior. Low carbon Astroloy was heat treated to four very different microstructures with various combinations of fine (500A) and coarse (2000-8000A) matrix gamma and grain boundaries with and without carbides and primary gamma'. GRA

N81-26240# Materials Research Labs., Ascot Vale (Australia).

INFLUENCE OF REMELTING CONDITIONS ON THE PERFORMANCE OF LOW ALLOY ESR STEEL IN THE AS-CAST CONDITION: SMALL LABORATORY INGOTS

Richard C. Andrew, George M. Weston, and Graham Clark Oct. 1980 40 p refs

(AD-A099294; MRL-R-786; AR-002-364) Avail: NTIS HC A03/MF A01 CSCL 11/6

The mechanical properties of three ingots of a low-alloy steel produced in an experimental ESR furnace are assessed in the as-cast, heat-treated condition. In general, the tensile, notch impact toughness, fracture toughness and fatigue properties of these ingots compare favorably with those determined for a wrought, vacuum-degassed electric furnace steel of similar composition. Variations in mechanical properties within, as well as between, ingots are correlated with differences in chemical composition, inclusion content, inclusion morphology and solidification geometry brought about by changes in the remelting conditions. Author (GRA)

N81-26241# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgical Engineering and Materials Science.

THE ROLE OF HYDROGEN IN THE STRESS CORROSION CRACKING OF HIGH STRENGTH ALUMINUM ALLOYS Final Report, 1 Dec. 1976 - 31 Dec. 1980

A. W. Thompson and I. M. Bernstein 1 Mar. 1981 38 p refs

(Contract F49620-77-C-0003; AF Proj. 2306)
(AD-A098802; CMU-AFOSR-A1-4; AFOSR-81-0403TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

The objective of this program has been to understand the stress corrosion cracking (SSC) behavior of high strength aluminum alloys, and in particular to understand the role played by hydrogen embrittlement in such cracking. The approach taken was to study microstructural effects on both hydrogen embrittlement and SCC, and to establish, insofar as possible, microstructural and fractograhic correlations with cracking behavior, and detailed understanding of the mechanical behavior of hydrogen charged material. When this program began, there existed only a single unconfirmed report of hydrogen embrittlement in a high strength aluminum alloy. That report was confirmed (on 7075-T651), and extensive additional evidence acquired (on 7075, 2124 and 7050, in a variety of heat treatments), permitting us to assemble a complete and detailed description of hydrogen embrittlement and its dependence on microstructure in Al alloys, in some 14 publications. A parallel effort on SCC behavior has also been conducted, using the technique of Mode I - Mode III testing to provide information on the relative contributions of hydrogen embrittlement and anodic dissolution to SCC. The Mode I data for 7075 showed a close parallel to the hydrogen charging results, in microconstructural dependence and in fractography. The Mode III data showed that the anodic dissolution component of SCC is small compared to hydrogen embrittlement, and moreover, has a much weaker dependence on microstructure. GRA

N81-26242# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.

AN IMPROVED MODEL FOR SECOND PHASE PARTICLE INTERACTION ANALYSIS Interim Report, Sep. - Dec. 1980 - M.S. Thesis

Roberts R. Batarags Nov. 1980 83 p refs
(Grant AF-AFOSR-3533-78; AF Proj. 2307)
(AD-A099149; AFOSR-81-0467TR; SM80-14) Avail: NTIS HC A05/MF A01 CSCL 11/6

In high-strength alloys, microstructure can influence toughness in a manner not yet fully quantified. Computational mechanics offers a tool whereby the events leading to fracture may be simulated, but the success of such an enterprise depends heavily upon the quality of the model employed. This report outlines a sequence of events thought to preceded ductile fracture and presents a finite element model designed to capture the main events. The model is considered to be an improvement over an earlier one, and data are presented to support this conclusion. Author (GRA)

N81-26243# Illinois Univ. at Urbana-Champaign. Dept. of Metallurgy and Mining Engineering.

DIFFUSION OF HYDROGEN, DEUTERIUM, AND TRITIUM IN NIOBIUM Ph.D. Thesis

G. R. Matusiewicz 1981 179 p refs
(Contract DE-AC02-76ER-01198)
(DOE/ER-01198/1346) Avail: NTIS HC A09/MF A01

The diffusion of hydrogen in niobium was investigated over the temperature range 148 to 500 K using measurements of the elastic after effect caused by long diffusion (the Gorsky Effect). Relaxation curves for pure annealed niobium were generally not of the single exponential form expected from the Gorsky Effect theory, but were described well by a sum of two exponential curves with different amplitudes and relaxation times. The effects of oxygen and nitrogen interstitials on the diffusion were studied and were not in agreement with conventional trapping models. Deuterium and tritium diffusion in niobium were also studied, and non classical isotope effect was observed. Hydrogen diffusion coefficients in several Nb-Ta alloys were measured, and the diffusivity in all these alloys exhibited a non-Arrhenius temperature dependence. Experimental results were compred to several models for diffusion and trapping. A model is presented which can account for the form of the relaxation curves observed in pure, annealed niobium. DOE

N81-26244# Oak Ridge National Lab., Tenn. Chemical Technology Div.

DIRECT ACID DISSOLUTION OF ALUMINUM AND OTHER METALS FROM FLY ASH

A. D. Kelmers, B. Z. Egan, F. G. Seeley, and G. D. Campbell 1981 17 p refs Presented at the AIME Symp. on Hydrometallurgy, Chicago, 22-26 1981; sponsored by Society on Mining Engineers and the Metallurgical Society
(Contract W-7405-eng-26)
(CONF-810202-6) Avail: NTIS HC A02/MF A01

Fly ash could provide a significant domestic source of alumina and thus supply a large part of the US needs for aluminum and possibly also several other metals. The aluminum and other metals can be solubilized from fly ash by acid dissolution methods. The aluminum may be present in any or all of three solid phases: (1) crystalline; (2) glassy amorphous; and (3) irregular, spongy amorphous. The chemistry of these phases controls the solubilization behavior. The aluminum in high-calcium western ashes is primarily found in the amorphous and much of it can be solubilized by using short time ambient-temperature leaching. Little of the aluminum in the low calcium eastern ashes is solubilized under ambient-temperature conditions, and only a portion can be solubilized even at reflux temperature conditions. DOE

N81-26245# Argonne National Lab., Ill.

STRUCTURAL RELATIONSHIPS IN RARE EARTH-TRANSITION METAL HYDRIDES

B. D. Dunlap, P. J. Viccaro, and G. K. Shenoy 1980 13 p Presented at the Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, Colo., 7-11 Apr. 1980
(Contract W-31-109-eng-38)
(CONF-800402-20; SSS-80-9) Avail: NTIS HC A02/MF A01

Several structural types of form AB2, AB3, A2B7, and AB5 (A = rare earth, B = transition metal) are known to be closely related, with local environments which are very similar among the different compounds. Based on these relationships, we suggested that hydride phases A(sub 1)B(sub m)H(sub n) should be related according to the relationships n(AB3) = 1/3n(AB5) + 2/3n(AB2) and n(A2B7) = n(AB5) + n(AB2) where the n(AB(sub m) are observed hydrogen phase concentrations. It is shown that the phases observed in pressure composition isotherms for AB3 and A2B7 systems can be understood from this viewpoint. A discussion is given of the maximum hydrogen concentration possible in the compounds having these structure types. DOE

N81-26246# Oak Ridge National Lab., Tenn.

LONG-TERM CORROSION OF Cr-Mo STEELS IN SUPER-HEATED STEAM AT 482 AND 538 C

J. C. Griess, J. H. DeVan, and W. A. Maxwell 1980 29 p refs Presented at the Corrosion '81 Ann. Meeting, Toronto, 6-10 Apr. 1981 Sponsored in part by NUS Corp., Clearwater, Fla.
(Contract W-7405-eng-26)
(CONF-810402-8) Avail: NTIS HC A03/MF A01

The corrosion of several Cr-Mo ferritic steels was investigated in superheated steam at an operating power plant. Tests were conducted at 482 and 538 C (900 and 1000 F) in a once-through loop for times up to 28,000 h. Chromium concentrations ranged from 2.0 to 11.3%, and the effect of surface preparation on corrosion was investigated. Only one of many specimens showed evidence of exfoliation at 482 C, but at 538 C exfoliation occurred on at least some of the specimens of most materials; the exceptions were the alloy with the highest chromium content (Sandvik HT-9), one heat of 9 Cr-1 Mo steel with the highest silicon content, and Sumitomo 9 Cr-2 Mo steel, which was in test for only 19,000 h. Parabolic oxidation kinetics adequately described the corrosion process for about the first year, after which corrosion rates were constant and lower than predicted from extrapolation of the initial part of the penetration versus time curves. DOE

N81-26247# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

CORROSION OF METALS IN OIL SHALE ENVIRONMENTS

A. Levy and R. Bellman, Jr. Dec. 1980 27 p refs Presented at the Natl. Assoc. of Corrosion Engr. Conf., Corrosion '81, Toronto, 6-10 Apr. 1981
(Contract W-7405-eng-48)
(LBL-12019; CONF-810402-10) Avail: NTIS HC A03/MF A01

In the corrosion of mild, low alloy and stainless steel in elevated temperature in-situ oil shale retorting environments was investigated. The catastrophic oxidation-sulfidation attack that can

occur in in-situ retorts is documented for a thermowell consisting of a mild steel pipe protecting a stainless steel sheathed thermocouple assembly. The behavior of metals under a number of varying conditions such as service temperature, type of shale and oil content of shale is presented. The potential of coatings on mild steel to extend its service range in shale retorting environments was determined for pack aluminide type coatings. DOE

N81-26248# Louisiana Dept. of Transportation and Development, Baton Rouge. Research and Development Section.
EVALUATION OF CORROSION INHIBITOR Final Report, Feb. 1979 - May 1980
Sheldon M. Law and Masood Rasoulian May 1980 45 p refs
(PB81-159980; LA-79-1C(B); FHWA/LA-80/141; RR-141)
Avail: NTIS HC A03/MF A01 CSCL 11F

The properties of concrete were evaluated using a commercially available corrosion inhibitor (Darex) as an additive to the concrete. Darex corrosion inhibitor does protect some against corrosion of steel embedded in concrete, but the extent was not defined. Strength is higher for corrosion inhibitor treated concrete than for reference concrete (not treated). Darex corrosion inhibitor does improve the general mix properties of air entrained concrete. Concrete using a corrosion inhibitor as an additive costs approximately 22 percent more than conventional concrete, but will not be as expensive as other types of treatments. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-26249 Drexel Univ., Philadelphia, Pa.
DETERMINATION OF THE VISCOSITY OF CERTAIN LIQUID METAL GLASS-FORMING ALLOYS Ph.D. Thesis
Jerry Irwin Steinberg 1981 219 p
Avail: Univ. Microfilms Order No. 8111308

The viscosities of Fe40Ni40P14B6, Fe40Ni40B20, Pd82Si18, and Pd77.5Si16.5Cu6 were measured. These alloys exhibit deep eutectics and become amorphous when rapidly quenched to ambient temperatures. The iron based alloys which require large cooling rates, have viscosities in the centipoise range, typical of other liquid metals. Both palladium based alloys, which require relatively low cooling rates, have viscosities which are two orders of magnitude larger than any other known liquid metals. The measurement of these anomalous viscosities was accomplished using an oscillating cup viscometer. The normal operating range of this instrument was extended to include the case of large viscosity liquids. Using standard fluids it is shown that accurate measurements of viscosity can be obtained for both large and small values of viscosity. Dissert. Abstr.

N81-26250 Cornell Univ., Ithaca, N. Y.
RESONANCE RAMAN SCATTERING IN THE CONDUCTING POLYMERS (CH)x AND (CD)x Ph.D. Thesis
Lawrence Stuart Lichtmann 1981 374 p
Avail: Univ. Microfilms Order No. 8110963

Resonance Raman spectra were obtained in high quality samples of the cis and trans isomers of polyacetylene (CH)x at 77 K. Both normal (CH)x and its deuterated analog, (CD)x were investigated. Excitation wavelengths covering the entire spectrum from 458 to 675 nm were employed. Dissert. Abstr.

N81-26251 Massachusetts Univ., Boston.
BIREFRINGENCE RELAXATION STUDIES ON POLYETHYLENE Ph.D. Thesis
David P. Anderson 1981 300 p
Avail: Univ. Microfilms Order No. 8110301

The total birefringence and stress on film samples were measured as functions of time after deformation. The crystalline contribution to the birefringence was caculated from crystalline orientation functions for high density polyethylene. The amorphous birefringence was determined as the difference between total and crystalline components. The degree of crystallinity for high and low density polyethylenes and the linear low density polyethylenes were determined. The weight fraction crysallainity was determined by X-ray diffraction and specific volume, the volume fraction crystallinity by density. Dissert. Abstr.

N81-26252 Connecticut Univ., Storrs.
SYNTHESIS AND CHARACTERIZATION OF LIQUID CRYSTALLINE ENAMINE-KETONES Ph.D. Thesis
Brian Chester Benicewicz 1981 82 p
Avail: Univ. Microfilms Order No. 8111903

Four series of compounds containing the six-membered hydrogen-bonded enamine ketone ring were synthesized. The thermodynamic properties of these compounds were determined by differential thermal analysis (DTA/DSC). The transition temperatures were checked with a thermal optical analyzer. This also allowed microscopic inspection of the solid and melt textures in polarized light which aided in the identification of mesophase types. The thermodynamic relations of each series was discussed. Comparisons between the series and with other series of compounds were made to examine the effect of molecular structure on the liquid crystalline properties of the enamine ketone compounds. The thermal data indicate that the long rigid core is more important in the stability of the nematic mesophase than the flexible aliphatic tails. Comparisons of the all-ring series with a series of oligomeric polyphenyls showed that, in addition to lowering the transition temperatures, replacement of a phenyl ring with an enamine-ketone ring tended to considerably increase the solubilities of the compounds. Dissert. Abstr.

N81-26253 Massachusetts Univ., Boston.
SYNTHESIS AND CHARACTERIZATION OF HOMOPOLYMERS AND COPOLYMERS OF 2,6-DIARYLPHENOLS Ph.D. Thesis
David Eric Dana 1981 246 p
Avail: Univ. Microfilms Order No. 8110321

A synthetic route to symmetrical 2,6-diarylphenols(1) was developed. This route has, as its key step, a phase transfer catalyzed double nucleophile displacement reaction of 1,3-diarylcyclohexanone. The latter compound is then converted to 1 by catalytic dehydrogenation. Phenols prepared in this way were 2,6-bis(p-tolyl)phenol(1a), 2,6-bis(p-methoxyphenyl)phenol (1b) and 2,6-bis(p-biphenyly)phenol(1c). All intermediate and products were characterized by elemental analysis, IR, and NMAR spectroscopy. Dissert. Abstr.

N81-26254 Connecticut Univ., Storrs.
POLYSTYRENE COLLOIDS. 1: SYNTHESIS USING A NOVAL INITIATOR. 2: HETEROGENEOUS CATALYSIS OF SUCROSE INVERSION Ph.D. Thesis
Prakash Mallya 1981 126 p
Avail: Univ. Microfilms Order No. 8111910

Polystyrene lattices containing only surface sulfonate groups were synthesized using the initiator disodium bis (4-sulfomethyl benzoyl) peroxide in the absence of added emulsifiers. The initiator was synthesized through a sequence of reactions involving six steps starting from para-toluic acid. The initiator was used for the emulsion polymerization of styrene in the absence of added surfactants. The effect of the variation of monomer concentration, initiator concentration, and ionic strength on the final number and diameter of particles was investigated. The lattices, after purication by ion-exchanging with a mixed bed resin, were characterized by HOTS for particle size, by conductometric and potentiometric titrations for surface acid concentration and by ISS for the naturenature of the surface atoms. Only strong acid groups were found to be present on the surface, attributed to sulfonic acid. Dissert. Abstr.

N81-26255 Dartmouth Coll., Hanover, N.H.
STUDIES OF EQUILIBRIUM AND DYNAMIC PROPERTIES OF POLYMERS Ph.D. Thesis
Marc Lewis Mansfield 1980 173 p
Avail: Univ. Microfilms Order No. 8112283

The effect of fluctuations in the internal coordinates on the end to end length of a macromolecule in a fixed rotational isomeric state is considered. The conformational properties of poly(alkene sulfone)s are examined. A general formula is derived for the mean square radius of gyration of a star molecule each

of whose rays is a Kratky-Porod wormlike chain of arbitrary length and with arbitrary angular restrictions at the junction point. The time dependence of the apparent translational diffusion coefficient given by the low angle light scattering structure factor of Rouse-Zimm chains is considered. A model of polymer chain dynamics is considered in an attempt to explain the dielectric relaxation of perpendicular dipole polymers. Dissert. Abstr.

N81-26256 Massachusetts Univ., Boston.
THERMODYNAMICS OF PLASTICIZATION IN NETWORK POLYMER-DILUENT SYSTEMS Ph.D. Thesis
Peter Moy 1981 150 p
Avail: Univ. Microfilms Order No. 8110355

The macroscopic and microscopic interactions of water with a model epoxy resin system are investigated. Isothermal sorption studies indicate that water interacts specifically with the epoxy resin at ambient temperatures. At high temperatures, the sorption process becomes more idealized. The molecular interaction was studied using broadline nuclear magnetic resonance and infrared spectroscopy. The NMR results indicated that at low concentrations, the mobility of the water in the polymer was severely restricted. The infrared data suggest that the preferential interaction of water with hydrogen bonded groups in the polymer may contribute to the unusually effective plasticization process. Calorimetric results show that a strong depression of the glass temperature of the resin system is caused by small amounts of sorbed water. The characterization of network polymers by differential scanning calorimetry resulted in the experimental observation that while the glass temperature rose as expected with the degree of cross-linking, the incremental specific heat at T(g) was more strongly dependent upon the cross-linked density. Dissert. Abstr.

N81-26257 Case Western Reserve Univ., Cleveland, Ohio.
THEORETICAAL AND EXPERIMENTAL STUDIES OF LASER LIGHT SCATTERING IN SOLUTIONS OF INTERACTING MACROMOLECULES. APPLICATION TO CHARACTERIZATION OF CARTILAGE PROTOGLYCANS Ph.D. Thesis
Hertsel Reihanian 1981 230 p
Avail: Univ. Microfilms Order No. 8109604

Laser light scattering was used to investigate the solution properties of bovine nasal proteglycan subunit (PGS) in dilute and semidilute solution regimes. In dilute aqueous NaCl, a pattern of self association of subunit is observed which is shown to occur at the globular protein hook region of the core protein. In solutions of low ionic strength, expansion of the macromolecules and enhancement of elelectrostatic repulsions lead to intermolecular ordering of the proteglycan subunits. Titration of a dilute solution of subunit with hyaluronic acid results in a sigmoidal behavior of Stokes radius, indicating the formation of aggregates of higher molecular weight results from the noncovalent association of proteglycan with hyaluronate. Characterization of two soluble forms of link protein in aqueous NaCl and Tris by quasielastic laser light scattering technique indicates that link proteins exists in an oligomeric state in these solvents.
Dissert. Abstr.

N81-26258 Case Western Reserve Univ., Cleveland, Ohio.
STRUCTURAL STUDIES OF POLYSACCHARIDES IN SOLUTION Ph.D. Thesis
Jeffrey George Southwick 1981 238 p
Avail: Univ. Microfilms Order No. 8109611

Studies of polysaccharide systems were undertaken in an effort to understand the structures responsible for the very high viscosities evident in these systems. Quasielastic light scattering techniques were applied to a particular system, xanthan gum, in order to characterize the macromolecular properties in dilute solution, and also to probe intermolecular interactions at high concentrations. Quasielastic light scattering obtains hydrodynamic information without the application of an applied shear stress, and therefore has the advantage of not perturbing weakly interacting intermolecular structures. Viscosity, optical rotation, and flow birefringence measurements were also obtained which provide additional data helpful in interpreting the light scattering results. Dissert. Abstr.

N81-26259*# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
SURFACE ACOUSTIC WAVES/SILICON MONOLITHIC SENSOR PROCESSOR
Stephen T. Kowel, Phillip G. Kornreich, Mohammed Ayub Fathimulla, and Ebrahim A. Mehter Jun. 1981 27 p refs
Original contains color illustrations
(Grant NsG-1611)
(NASA-CR-164476; Rept-4) Avail: NTIS HC A03/MF A01 CSCL 11F

Progress is reported in the creation of a two dimensional Fourier transformer for optical images based on the zinc oxide on silicon technology. The sputtering of zinc oxide films using a micro etch system and the possibility of a spray-on technique based on zinc chloride dissolved in alcohol solution are discussed. Refinements to techniques for making platinum silicide Schottky barrier junctions essential for constructing the ultimate convolver structure are described. A.R.H.

N81-26260*# Mississippi Univ. for Women, Columbus. Dept. of Physical Sciences.
MONOMERS FOR THERMOSETTING AND TOUGHENING EPOXY RESINS Annual Progress Report
J. Richard Pratt 1 Jun. 1981 37 p refs
(Grant NsG-1539)
(NASA-CR-164479; APR-2) Avail: NTIS HC A03/MF A01 CSCL 07C

Eight glycidyl amines were prepared by alkylating the parent amine with epichlorohydrin to form chlorohydrin, followed by cyclization with aqueous NaOH. Three of these compounds contained propargyl groups with postcuring studies. A procedure for quantitatively estimating the epoxy content of these glycidyl amines was employed for purity determination. Two diamond carbonates and several model propargly compounds were prepared. The synthesis of three new diamines, two which contain propargyloxy groups, and another with a sec-butyl group is in progress. These materials are at the dinitro stage ready for the final hydrogenation step. Four aromatic diamines were synthesized for mutagenic testing purposes. One of these compounds rapidly decomposes on exposure to air. Author

N81-26261# Lockheed Missiles and Space Co., Sunnyvale, Calif. Missiles Systems Div.
CURE MONITORING TECHNIQUES FOR ADHESIVE BONDING TECHNIQUES Final Report, 1 May 1979 - Sep. 1980
C. A. May, A. Wereta, Jr., J. S. Fritzen, and F. L. Keck Wright-Patterson AFB, Ohio AFWAL Nov. 1980 20 p refs
(Contract F33615-79-C-5046; AF Proj. 2419)
(AD-A099418; LMSC-D058816; AFWAL-TR-80-4171) Avail: NTIS HC A02/MF A01 CSCL 11/1

As a result of the work reported herein a foundation has been developed for automated bonding cycle control. The monitoring system was improved through the development of a mathematical model which affords a theoretical understanding of the dielectric signals and permits their chemorheological interpretation. The mechanical reliability of the probe was improved to minimize in-process failures. It was demonstrated that the shape of the dielectric curve was dependent on the chemical composition of the adhesive and was a useful tool for the optimization of cure cycles. Environmental testing of joints containing probes indicated that combinations of moist environments and elevated temperatures caused a degradation of bond performance. However, surface treatments can be applied to the probe without destroying the dielectric monitoring capability and should be evaluated as a solution to this problem. Evidence was also developed that it may be feasible to use the probe to detect the ingress of moisture into a bonded joint. Author (GRA)

N81-26262# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Materials Lab.
THE USE OF THE SHORT BEAM SHEAR TEST METHOD ON METAL-TO-METAL ADHESIVE BONDS. PART 1: 7075-T6 ALUMINUM Final Report, May - Jul. 1980
Neil R. McDevitt and William L. Baun Apr. 1981 32 p refs
(AF Proj. 2419)
(AD-A099131; AFWAL-TR-81-4008-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 11/1

Most literature studies show that failure of an adhesive joint occurs, in general, in the region of the adhesive-oxide interface.

The three major mechanical tests used today usually provide information on only the bulk adhesive. This paper presents the use of the short beam shear test as a means of loading the adhesive-oxide interface with as much shear force as possible in order to determine any subtle changes that may occur in this area during environmental testing. GRA

N81-26263# Union Carbide Corp., Tarrytown, N.Y.
ORGANOSILANE POLYMERS. 4: POLYCARBOSILANE PRECURSORS FOR SILICON CARBIDE Final Technical Report, Aug. 1978 - Dec. 1980
C. L. Schilling, J. P. Wesson, and T. C. Williams Jan. 1981 33 p refs
(Contract N00014-75-C-1024)
(AD-A099030; TR-80-1) Avail: NTIS HC A03/MF A01 CSCL 11/9

The current objectives of this project are: (1) optimized preparations of tractable polycarbosilane precursors for silicon carbide; (2) conversion of such polycarbosilanes to silicon carbide including shaped articles thereof, such as fibers; and (3) development of fundamental understanding of the preparative and pyrolytic chemistry. One step preparations of tractable polycarbosilanes are achieved through silicon-carbon bond-forming reactions of vinylic or chloromethyl (ClCH2-) silanes. These polymers are directly convertible to silicon carbide compositions by atmospheric pressure pyrolysis. Backbone branching is recognized as essential for practical conversion of such polycarbosilanes to silicon carbide. GRA

N81-26264# Virginia Polytechnic Inst. and State Univ., Blacksburg. Polymer Materials and Interface Lab.
BUTADIENE-ISOPRENE BLOCK COPOLYMERS AND THEIR HYDROGENATED DERIVATIVES Final Report, 25 Sep. 1978 - 24 Sep. 1980
J. E. McGrath, G. L. Wilkes, Y. Mohajer, I. C. Wang, S. Abouzahr, and M. K. Martin Apr. 1981 136 p refs
(Grant DAAG29-78-G-0201)
(AD-A098792; ARO-15859.3-MS) Avail: NTIS HC A07/MF A01 CSCL 07/4

This report includes the following papers: Anionic Copolymerization of Butadiene and Isoprene with Organolithium Initiators in Hexane; The Reactivity of Polydiene Anions with Divinyl Benzene; Hydrogenated Linear Block Copolymers of Butadiene and Isoprene; Effects of Variation of Composition and Sequence Architecture on Properties; and Chemorheology. Author (GRA)

N81-26265# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
SINTERABLE POWDERS FROM LASER DRIVEN REACTIONS Annual Report, 1 Jul. 1979 - 30 Jun. 1980
John S. Haggerty Jul. 1980 113 p refs
(Contract N00014-77-C-0581; ARPA Order 3808)
(AD-A099433; MIT-EL-81-003; AR-3) Avail: NTIS HC A06/MF A01 CSCL 11/2

Extremely fine, uniform ceramic powders have been synthesized from SiH4, NH3 and C2H4 gas phase reactants that are heated by absorbing optical energy emitted from a CO2 laser. Resulting Si, Si3N4 and SiC powders have been characterized in terms of parameters which are important for densification processes. They are virtually ideal. The spherical particles typically have mean diameters from 120 to 1000 A. The standard deviation is typically 25-45% and the diameter of the largest observed particle is typically less than twice that of the smallest particle. Purities are extremely high. The laser heated process has been modeled in terms of fluid flow and heat transfer criteria. Many fundamental property measurements were made to provide data for these calculations. The process is extremely efficient, approximately 95% of the SiH4 is reacted in a single pass through the laser beam and approximately 2 kwhr. of energy are required per kilo of Si3N4. The resulting powders have been processed into dense pieces using several shaping techniques. The Si powders were densified to precisely controlled levels designed to yield high density reaction bonded silicon nitride (RBSN). Nitriding kinetics were rapid at low temperatures because of the small particle sizes. Characteristic dimensions of RBSN microstructures approximated the initial particle dimensions. Sintering experiments with pure Si3N4 powder gave indications that densification occurred on a local scale. Author (GRA)

N81-26266# Materials Research Labs., Ascot Vale (Australia).
THE MECHANISM OF STRENGTH LOSSES IN NYLON 6,6 PARACHUTE MATERIALS AFTER SALT WATER CONTAMINATION
G. T. Egglestone Nov. 1980 21 p refs
(AD-A099297; MRL-R-801; AR-002-385) Avail: NTIS HC A02/MF A01 CSCL 11/5

Tensile strength losses in nylon 6,6 suspension lines contaminated with seawater result from abrasion damage due to salt crystals that penetrate the weave structure and cause shearing of the nylon filaments. This is contrary to a previous mechanism that attributed these losses to the increased local relative humidity and moisture uptake caused by deliquescent salts, in particular magnesium chloride (MgCl2.6H2O), present in seawater. Analysis using the Rheovibron Viscoelastometer has shown that the presence of MgCl2.6H2O on nylon 6,6 material does not increase the local relative humidity but decreases it, leaving the nylon in a drier state. Author (GRA)

N81-26267# McDonnell-Douglas Research Labs., St. Louis, Mo.
MAGNETIC RESONANCE STUDIES OF EPOXY RESINS Final Report, 7 Sep. 1979 - 7 Dec. 1980
I. M. Brown, A. C. Lind, and T. C. Sandreczki 7 Dec. 1980 83 p refs
(Contract N00019-79-C-0414)
(AD-A099225; MDC-Q0721) Avail: NTIS HC A05/MF A01 CSCL 11/9

Electron paramagnetic resonance (EPR) and hydrogen nuclear magnetic resonance (NMR) were used to investigate main-chain molecular motions in the epoxy resins tetraglycidyldiaminodiphenylme thane (TGDDM) and diglycidyl ether of bisphenol A (DGEBA) cured with dimethyldiaminohexane (DDH) and diethylenetriamine (DETA). The cured resins were studied close to the glass transition as a function of temperature and as a function of solvent content (methylene chloride and water). In the EPR approach, stable nitroxide free radicals were used either as spin probes or spin labels to probe their dynamic environment in the polymer. The uncured TGDDM was spin labeled at the epoxy group with nitroxide amines to form either an end label or a quaternary base. The latter was found to undergo a Hofmann elimination reaction to release a stable nitroxide spin probe. In the dry cured epoxy resins at each temperature, the EPR lineshapes of the spin labels and spin probes could be characterized by one value of the motional correlation time. The temperature dependence of this motional correlation time obeys the WLF equation. On the other hand, at some solvent contents, the EPR lineshapes could be resolved into two spectra associated with a slow phase and a fast phase indicating a bimodal distribution of motional correlation times. The solvent dependence of the motional correlation times for the fast phases obeyed a modified form of the Fujita-Doolittle equation. The two phases were identified with nitroxides located in regions with different microstructures, viz., regions with high crosslink density (the slow phase) embedded in and bound to regions of low crosslink density (the fast phase). GRA

N81-26268# California Univ., Berkeley. Dept. of Materials Science and Mineral Engineering.
IMPACT DAMAGE AND EROSION OF CERAMIC AND COMPOSITES Final Report, 1 Jan. - 31 Dec. 1980
A. G. Evans, N. Burlingame, S. S. Chiang, D. R. Clark, M. Drory, K. T. Faber, W. L. Fraser, M. E. Gulden, M. D. Huang, W. Kennedy et al 31 Dec. 1980 222 p refs
(Contract N00014-79-C-0159)
(AD-A098966) Avail: NTIS HC A10/MF A01 CSCL 11/2

Studies of the mechanical strength of ceramics were conducted. These range from studies of toughness to identation fracture, thermal shock and erosion. The central theme of this report concerns the study of those facets of mechanical behaviors that influence the structural integrity of ceramic components. Specific topics include: On the Grain Size Dependence of Strength; Martensite Transformations in Zirconia--Particle size effects and toughening; Quantitative Studies of Thermal Shock in Ceramics Based on a Novel Test Technique; Toughening of Ceramics by Circumferential Microcracking; Residual Stresses and Microcracking Induced by Thermal Contraction Inhomogeneity; A Simple Method for Adhesion Measurements; The Martensite Crystallography of Tetragonal Zirconia; Wear Mechanics in Ceramics; and

Particle Size Distribution Effects on Solid Particle Erosion in Brittle Materials. GRA

N81-26269# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.
STRUCTURE DETERMINATION OF CROSSPOLYMERIZED POLY (1, 11 - DODECADIYNE) Technical Report, 1 Mar. 1981 - 28 Feb. 1982
Jerome B. Lando and M. Thakur 5 May 1981 23 p refs
(Contract N00014-88-C-0213)
(AD-A099301; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

Electron diffraction patterns were obtained from cross-polymerized crystals of poly (1,11-dodecadiyne), formed by casting thin (= 200A) films of uncrosspolymerized polymer from chloroform. Two orientations of these crystals were obtained by varying the evaporation rate of the chloroform solvent. Cross-polymerization resulted from subsequent exposure of these samples to Co60 radiation. Thirty-six independent reflections were obtained from the a^*c^* reciprocal lattice net and a lattice net having b^* and the (h 0 h) reciprocal lattice direction as orthogonal axes. Refinement of the structure was accomplished with these data. The unit cell of the crosspolymerized material was monoclinic, space group P2(1)/n,a = 9.17A, b (hydrocarbon Chain axis and unique axis) = 12.15 A, c (polydiacetylene axis) = 9.92A and the angle beta = 123.5 degrees.
Author (GRA)

N81-26270# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
EVALUATION OF TUBULAR CERAMIC HEAT-EXCHANGER MATERIALS IN RESIDUAL-OIL-COMBUSTION ENVIRONMENT
G. C. Wei and V. J. Tennery Mar. 1981 167 p refs
(ORNL/TM-7578) Avail: NTIS HC A08/MF A01

Fourteen different structural ceramic tubes were exposed to a residual oil combustion environment at 1200 C for 500 h with a total of six thermal cycles. Silicon carbide and alumina ceramics survived the exposure. Best candidates for heat exchanger use in residual oil combustion environments include silconized silicon carbide, pressureless sintered silicon carbide, and high purity alumina. Cordierite, mullite, and zirconia mullite cracked extensively. Molten nodules or deposits of cristobalite, tridymite, and silicate glass containing fuel oil impurities such as Na, Al, Ca, V, Fe, and Ni formed on the upstream side of the SiC based specimens. Active oxidation proceeds with the release of CO and CO2 at the interface of the nodules or deposits formed on the SiC. Fuel oil impurities including Fe and Ni reacted with the free Si in siliconized SiC to form low melting alloys. Surface roughness and grain growth were observed in pressureless sintered SiC as a result of reactions. DOE

N81-26271# Factory Mutual Research Corp., Norwood, Mass.
PHYSICO-CHEMICAL AND COMBUSTION/PYROLYSIS PROPERTIES OF POLYMERIC MATERIALS
A. Tewarson Dec. 1980 83 p refs
(Contract NB79-NADA-0014)
(PB81-158651; NBS-GCR-80-295) Avail: NTIS HC A05/MF A01 CSCL 11I

Data for the physico-chemical and combustion/pyrolysis properties of aromatic and nonaromatic granular and foamed polymeric materials are presented for use in fire modeling as well as for hazard evaluations and basic understanding of fires. The physico-chemical and combustion/pyrolysis properties include chemical formulae, stoichiometric air-to-fuel ratio, net heat of complete combustion, heat required to generate a unit mass of vapors, surface re-radiation loss, surface temperature, combustion efficiency including its convective and radiative components, product yields, light obscuration parameter, flame convective and radiative heat flux to the surface, Spalding's B-number modified for radiation and for combustion efficiency, normalized flame heights, ratio of CO2 concentration to gas temperature above ambient ratio of optical density per unit path length to gas temperature above ambient, and energy required to generate a combustible vapor-air mixture. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N81-26272# Comptroller General of the United States, Washington, D.C.
LIQUEFYING COAL FOR FUTURE ENERGY NEEDS
12 Aug. 1980 41 p refs
(EMD-80-84) Avail: NTIS HC A03/MF A01

The status of various coal liquefaction processes is reported. Research and development, as well as commercialization efforts are surveyed. Design, construction, and operation of coal liquefaction projects are summarized. S.F.

N81-26273 California Inst. of Tech., Pasadena.
DYNAMICS OF VAPOR EXPLOSIONS: RAPID EVAPORATION AND INSTABILITY OF BUTANE DROPLETS EXPLODING AT THE SUPERHEAT LIMIT Ph.D. Thesis
Joseph Emmett Shepherd 1981 191 p
Avail: Univ. Microfilms Order No. 8111496

A preliminary experimental investigation of the vapor explosion of a single droplet of liquid butane at the superheat limit was completed. These experiments provided the first detailed look at rapid evaporation taking place under conditions such that departures from equilibrium, evaporative fluxes, and fluid accelerations are orders of magnitude larger than observed under ordinary circumstances. Single short exposure photographs and fast response pressure measurements were used to obtain a description of the complete explosion process within a superheated drop immersed in a bubble column apparatus. Emphasis was placed on the early evaporative stage. Despite the apparant simplicity of the vapor explosion of a single superheated droplet. This experiment revealed a wide range of phenomena of varying complexity occurring at different stages of the explosion.
Dissert. Abstr.

N81-26274*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DISPERSION OF FLAMMABLE CLOUDS RESULTING FROM LARGE SPILLS OF LIQUID HYDROGEN
Robert D. Witcofski May 1981 10 p refs Proposed for presentation at the 16th Intersoc. Energy Conversion Eng. Conf., Atlanta, 9-14 Aug. 1981
(NASA-TM-83131) Avail: NTIS HC A02/MF A01 CSCL 21D

Preliminary findings of hydrogen vapor cloud dispersion experiments are reported. Basic information was obtained regarding the physical phenomena governing the dispersion of flammable clouds formed as the result of spills of large quantitites of liquid hydrogen. The experiments consisted of ground spills of up to 5.7 cubic meters (1500 gal.) of liquid hydrogen, with spill durations of approximately 35 seconds. Instrumented towers, located downwind of the spill site, gathered data on the temparature, hydrogen concentration, and turbulence levels as the hydrogen vapor cloud drifted downwind. Visual phenomena were recorded by motion picture and still cameras. For rapid spills, thermal and momentum induced turbulences cause the cloud to disperse to safe concentration levels and become positively buoyant long before mixing due to normal atmospheric turbulence becomes a major factor. S.F.

N81-26275*# Computer Sciences Corp., El Segundo, Calif. Engineering Systems Dept.
THE LEWIS CHEMICAL EQUILIBRIUM PROGRAM WITH PARAMETRIC STUDY CAPABILITY
Rene Sevigny May 1981 287 p
(Contract NAS8-31640)
(NASA-CR-161811) Avail: NTIS HC A13/MF A01 CSCL 21D

The program was developed to determine chemical equilibrium in complex systems. Using a free energy minimization technique, the program permits calculations such as: chemical equilibrium for assigned thermodynamic states; theoretical rocket performance for both equilibrium and frozen compositions during expansion;

incident and reflected shock properties; and Chapman-Jouget detonation properties. It is shown that the same program can handle solid coal in an entrained flow coal gasification problem. T.M.

N81-26276*# Computer Sciences Corp., El Segundo, Calif. Engineering Systems Dept.
ADDITION TO THE LEWIS CHEMICAL EQUILIBRIUM PROGRAM TO ALLOW COMPUTATION FROM COAL COMPOSITION DATA
Rene Sevigny Dec. 1980 271 p
(Contract NAS8-31640)
(NASA-CR-161809) Avail: NTIS HC A12/MF A01 CSCL 21D

Changes made to the Coal Gasification Project are reported. The program was developed by equilibrium combustion in rocket engines. It can be applied directly to the entrained flow coal gasification process. The particular problem addressed is the reduction of the coal data into a form suitable to the program, since the manual process is involved and error prone. A similar problem in relating the normal output of the program to parameters meaningful to the coal gasification process is also addressed. T.M.

N81-26277# IIT Research Inst., Chicago, Ill. Engineering Research Div.
INITIATION MECHANISMS OF SOLID ROCKET PROPELLANT DETONATION Final Report, Oct. 1975 - Oct. 1980
A. N. Takata and A. Wiedermann Mar. 1981 115 p refs
(Contract F49620-80-C-0007; AF Proj. 2308)
(AD-A099161; IITRI-J6352-FR; IITRI-J6511-FR; AFOSR-81-0466TR) Avail: NTIS HC A06/MF A01 CSCL 21/8

The purpose of this study is to identify mechanisms responsible for several accidental detonations of high-energy solid rocket propellant motors. Simple models were used to predict transient gas pressures within burning propellent cracks following arrival of a stress wave. Stress waves are the consequence of cracks propagating into a cavity containing gas at much higher pressure that initially within the crack. Two factors were found important in creating gas pressures of similar magnitude and duration as needed to initiate propellants by impact. Namely, the generation of melt or foam that sustains accelerated burning; and the production of stress waves that accelerate the burning by partially collapsing cracks and subsequently lessen crack expansion while the pressures continue to rise before decaying. Experiments designed to achieve DDT were unsuccessful due to inadequate piston closure of the void space over burning propellant. It was suspected that inadequate closure was due to blow off of melt raising pressures sufficiently to stop the piston before adequate closure was achieved. Author (GRA)

N81-26278# Virginia Commonwealth Univ., Richmond.
NEW CATALYSTS FOR THE INDIRECT LIQUEFACTION OF COAL Semiannual Technical Report
Gordon A. Melson 1981 16 p refs
(Contract DE-FG22-80PC-30228)
(DOE/PC-30228/T1) Avail: NTIS HC A02/MF A01

The synthesis and characterization of two series of supported metal compounds was achieved. These potentially catalytic materials were prepared from transition metal carbonyls and both simple oxide and zeolite supports by a newly developed synthetic procedure; spectroscopic and thermogravimetric techniques were employed for characterization. Evaluation of the ability of some of these materials to catalyze the hydrogenation of carbon monoxide was completed. Product distributions which are significantly different from those which are obtained by using conventionally prepared catalysts are produced with some of these materials. DOE

N81-26279# Commissariat a l'Energie Atomique, Gramat (France). Centre d'Etudes Nucleaires.
ELECTROLYTIC PRODUCTION OF HYDROGEN BY ELECTROCHEMICAL REDUCTION OF WATER AT 8500 C: CONSTRUCTION AND DETERMINATION OF THE CHARACTERISTICS OF AN ELECTROLYSIS CELL SURFACE OF 50 cm
J. C. Viguie 1980 37 p refs
(EUR-6987-FR) Avail: NTIS HC A03/MF A01

The electochemical chain is H2, H2O/Ni/0.91 ZrO2:0.09 Y2O3/oxide/O2. The influence of preparation on the resistivity of the solid electrolyte was been studied. A typical figure is 18 lambda cm at 8500 C. The cathode reactivity is dependent on the superficial concentration of the nickel grains on the interface. The maximum reactivity is achieved with a superficial resistance ranging between 50 and 150 m lambda. The disc support is a honeycomb-shaped ceramic whose composition was adjusted to meet the expansion coefficient of zirconia 9.10(+1). The support is chemically covered with a 15 microns nickel layer. Trial runs were made to insure that anodic and cathodic compartments were isolated and to determine the proper gas flow conditions. DOE

N81-26280# Harvard Univ., Cambridge, Mass. Energy and Environmental Policy Center.
VULNERABILITY REDUCTION STUDY. COAL AND SYNTHETICS. SECTION 3A: TECHNICAL APPENDIX
Aug. 1980 29 p refs
(Contract DE-AC01-80PE-70278)
(DOE/PE-70278/T4) Avail: NTIS HC A03/MF A01

This Appendix supports and explains key statements made in the chapter on Coal and Synthetics. Evidence is presented that coal supply will not be constrained by production or transportation factors through the 1980s. Any program to increase the direct use of coal in the industrial sector must take into account a number of identifiable difficulties. A deployment schedule for 10 oil shale projects was developed by the Office of Technology Assessment. This schedule, if adhered to, would result in an initial deployment of an oil shale industry of 400,000 bpd oil equivalent by 1990. In addition, the Appendix provides descriptions of those major elements of Federal legislation that bear directly on coal. DOE

N81-26281# Arizona State Univ., Tempe. Dept. of Chemical Engineering.
INDIRECT THERMAL LIQUEFACTION PROCESS FOR PRODUCING LIQUID FUELS FROM BIOMASS
J. L. Kuester 1980 24 p refs Presented at the 89th Ann. Meeting of the Am. Inst. of Chem. Engr., Portland, Oreg., 17-20 Aug. 1980
(Contract DE-AS02-76CS-40202)
(COO-2981-61; CONF-800802-24) Avail: NTIS HC A02/MF A01

A progress report on an indirect liquefaction process to convert biomass type materials to quality liquid hydrocarbon fuels by gasification followed by catalytic liquid fuels synthesis has been presented. A wide variety of feedstocks can be processed through the gasification system to a gas with a heating value of 500 + Btu/ SCF. Some feedstocks are more attractive than others with regard to producing a high olefin content. This appears to be related to hydrocarbon content of the material. The H2/CO ratio can be manipulated over a wide range in the gasification system with steam addition. Some feedstocks require the aid of a water-gas shift catalyst while others appear to exhibit an auto-catalytic effect to achieve the conversion. H2S content (beyond the gasification system wet scrubber) is negligible for the feedstocks surveyed. The water gas shift reaction appears to be enhanced with an increase in pyrolysis reactor temperature over the range of 1300 to 1700 F. DOE

N81-26282# Battelle Pacific Northwest Labs., Richland, Wash.
CHEMICAL COMPARISONS OF LIQUID FUEL PRODUCED BY THERMOCHEMICAL LIQUEFACTION OF VARIOUS BIOMASS MATERIALS
J. A. Russell, Peter M. Molton, and Steven D. Landsman Dec. 1980 17 p refs Presented at the 3d Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 17 Dec. 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8602; CONF-801210-22) Avail: NTIS HC A02/MF A01

Liquefaction of biomass in aqueous alkali at temperatures up to 350 C is an effective way to convert solid wastes into liquid fuels. The liquefaction oils of several forms of biomass differing in proportions of cellulose, hemi-cellulose, lignin, protein, and minerals were studied and their chemical composition

compared. It was that the proportions of chemical components varied considerably depending on the type of biomass liquefied. However, all the oils, even those produced from cellulose, had similar chemical characteristics due to the presence of significant quantities of phenols. These phenols are at least partially responsible for the corrosivity and viscosity commonly associated with biomass oils. The differences in chemical component distribution in the various biomass oils might successfully be exploited if the oil is to be used as a chemical feedstock. If the oil is to be used as a fuel, however, then reaction conditions will be a more important consideration than the source of biomass. DOE

N81-26283# California Univ., Livermore. Lawrence Livermore Lab.

DYNAMIC MECHANICAL AND MOLECULAR WEIGHT MEASUREMENTS ON POLYMER BONDED EXPLOSIVES FROM THERMALLY ACCELERATED AGING TESTS. 3: KRATON BLOCK COPOLYMER BINDER AND PLASTICIZERS

L. E. Caley and D. M. Hoffman 1981 11 p refs Presented at the Am. Chem. Soc. Symp. on the Chem. of Engine Combustion Deposits, Atlanta, 29 Mar. 1981
(Contract W-7405-eng-48)
(UCRL-85120-Vol-3; CONF-810308) Avail: NTIS HC A02/MF A01

The dynamic mechanical properties and molecular weight distribution of two experimental polymer bonded explosives, X-0287 and X-0298, maintained at 23, 60, and 74 C for 3 years were examined. The relaxation associated with the Kraton rubber block glass transition is observed in both X-0287 and X-0298. In the unaged X-0298 it occurs at -59 C and in the aged explosive at 50 C. This is caused by migration of the oil plasticizer out of the explosive. In X-0287 the Kraton rubber block T sub g is weak and broad due to the presence of the wax plasticizer. X-0287 has a second broad relaxation associated with the melting of the wax from 10 to 65 C. The molecular weight of the Kraton binder decreased with increasing accelerated aging temperature. The oil plaiticizer had no stabilizing effect, but below its melting point the wax reduced Kraton chain scission considerably. The simple random chain scission model predicted a 20.5 year use-life for X-0298, but X-0287 was stabilized against degradation below the wax melting point. DOE

N81-26284# Stanford Univ., Calif. High Temperature Gasdynamics Lab.

OPTICAL DIAGNOSTIC MEASUREMENTS OF COAL-SLAG PARAMETERS IN COMBUSTION MHD SYSTEMS

Peter Carl Ariessohn Aug. 1980 183 p refs
(Contract DE-AC01-80ET-15611)
(DOE/ET-15611/2; HTGL-119; EPRI-RP-468-1) Avail: NTIS HC A09/MF A01

A slag layer surface position monitor employing a laser triangulation method was developed and used to measure variations in slag layer thickness as a function of substrate temperature for a variety of ash loadings and total reactant flowrates. Slag layer thickness is seen to decrease with increasing substrate temperature and plasma velocity. The measurement of mean size and concentration of suspended ash droplets in the plasma exiting the M-8 combustor was accomplished utilizing a two wavelength transmissometer developed for this purpose. This instrument incorporates several unique features which were required to overcome the difficulties imposed by the MHD environment. Measurements obtained with this device show that mean ash droplet diameter is relatively independent of ash loading, combustor residence time and combustion stoichiometry, but is a decreasing function of plasma temperature. DOE

N81-26285# Miami Univ., Fla. Div. of Biology and Living Resources.

ENHANCEMENT OF HYDROGEN PHOTOPRODUCTION BY MARINE CHROMATIUM SP. MIAMI PBS 1071 GROWN IN MOLECULAR NITROGEN

Y. Ohta and A. Mitsui 1980 7 p refs Presented at the 6th Intern. Fermentation Symp. and 5th Intern. Symp. on Yeasts, London, Canada, Jul. 1980 Submitted for publication
(Contract DE-AC02-77CH-00178)
(CONF-800793-1) Avail: NTIS HC A02/MF A01

The marine Chromatium sp. Miami PSB 1071 was grown on molecular nitrogen as the sole source of nitrogen. These cells exhibited active hydrogen production in the light from hydrogen donor substances such as thiosulfate, sulfide, acetate, fumarate, malate and succinate. Hydrogen was produced at two to three times higher rates when two donor substances, succinate and thiosulfate (or succinate and sulfide) were used together. Hydrogen production rates as high as 6 micro moles hydrogen/mg protein/hr were observed in cells from the middle of the logarithmic growth phase cells. Hydrogen production was light dependent and hydrogen was consumed in the dark at a slower rate. High rates of hydrogen production were observed at seawater salinities and high light intensities. The response of growth and nitrogen fixation in this strain to environmental regulation suggest that it could be successfully used in saltwater based bio-solar hydrogen production systems. DOE

N81-26286# Arinc Research Corp., Annapolis, Md.

DEVELOPMENT OF A RELIABILITY PREDICTION METHODOLOGY FOR A GASIFICATION-COMBINED-CYCLE POWER PLANT

J. Blair, J. Witt, and M. Neely Nov. 1980 188 p refs
(EPRI-AP-1643) Avail: NTIS HC A09/MF A01

The application begins with the definition of all possible system states, or levels of output, at which the gasification combined cycle plant can operate. The plant's operation is then modeled as a Markov chain process, which allows an assessment of its expected output over all possible states as a function of time. Sensitivity analyses are performed to rank the plant's major components in terms of their impact on a defined measure of system reliability. The results of the plant assessment and the sensitivity analyses are presented, as well as the component level failure rate data base used to derive them. DOE

N81-26287# General Electric Co., Schenectady, N. Y. Dept. of Energy Systems Programs.

PFB COAL-FIRED COMBINED-CYCLE DEVELOPMENT PROGRAM. TEST EVALUATION REPORT: CURL TEST SERIES

1980 187 p
(Contracts DE-AC21-76ET-10377; EX-76-C-01-2357)
(FE-2357-69) Avail: NTIS HC A09/MF A01

Tests were performed in order to investigate corrosion and erosion of candidate gas turbine blade alloys for service in a Pressurized Fluidized Bed (PFB) combined cycle power plant. The tests also permitted an evaluation of hot gas cleanup equipment. The results are encouraging, indicating that it is possible to provide materials which can withstand the erosive/corrosive PFB environment. Further, it was found that the reduction of particulate efflux via cyclones was sufficient to eliminate excessive erosion of gas turbine components in the stationary cascades tested. The tests also demonstrated the great care required to obtain accurate and consistent data measurement in certain areas. Particle size distribution data indicated a high consistency of operation. On the other hand, difficulties were encountered in obtaining accurate and reliable indication of the alkali content of the exhaust gas. DOE

N81-26288# Ocean Management Associates, Saunderstown, R.I.

MARINE PLANT BIOMASS FOR ALCOHOL FUELS

Francis X. Cameron (Rhode Island Univ., Kingston), Henry S. Parker (Univ. Southeastern Massachusetts), J. M. Gates (Rhode Island Univ., Kingston), and Kevin Klarnet (Rhode Island Univ., Kingston) Mar. 1980 195 p refs
(PB81-154619; NAFC-80-12) Avail: NTIS HC A09/MF A01 CSCL 21D

A basic evaluation is made of the potential of marine plants as an economical source of substitute fuels. The potential of different species and cultivation techniques for marine biomass production are evaluated and compared. The analysis consists of a review of the cultivation and harvesting technology, the production costs and the expected biomass yield. Legal and institutional constraints as well as environmental and socioeconomic impacts are also evaluated. GRA

N81-26289# Public Technology, Inc., Washington, D. C.

ENERGY: COMPRESSED NATURAL GAS. AN ALTERNA-

TIVE VEHICULAR FUEL FOR LOCAL GOVERNMENTS (A CASE STUDY FROM THE URBAN CONSORTIUM)
1980 7 p refs
(Grant NSF ISP-78-12729)
(PB81-160012; NSF/RA-800356) Avail: NTIS HC A02/MF A01 CSCL 21D

Parameters in the choice of CNG as an alternative fuel including performance, engine wear, safety, environmental effects, and economics are discussed. Compressed natural gas (CNG) can be burned as a substitute fuel in existing gasoline engines which have been adapted to burn CNG without losing the ability to burn gasoline. The storage tanks can be installed in the trunk of a car or on the underside of a van and are connected to the gas/air mixer, which sits on top of the carburetor, near the fuel line/regulator assembly. The operator of the vehicle can switch to CNG from gasoline (or vice versa) by a control switch on the dashboard. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-26290 Massachusetts Univ., Amherst.
STABILITY OF GUYED TOWERS Ph.D. Thesis
Wen-Sen Chen 1981 204 p
Avail: Univ. Microfilms Order No. 8110316

The analysis considers short towers was supported by a single set of guy wires. The effect of various parameters on the critical load is reviewed. Equations and curves are presented which determine the critical load of a guyed tower. The dynamic criterion of stability is used to check the critical load obtained from the method of neutral equilibrium. To obtain an additional check on the critical load obtained in the linear analysis, as well as to analyze the effect of lateral loads, a finite deflection analysis is carried out. By taking the inelastic behavior of the mast into account, the true carrying capacity of the tower is obtained. A computer program for carrying out the finite deflecting solution is developed. To carry out either the elastic or the inelastic analysis. A new technique for the formulation of moment curvature thrust relationships is also presented. Dissert. Abstr.

N81-26291 Wisconsin Univ. - Madison.
AN EXPERIMENTAL STUDY OF THE DYNAMIC BEHAVIOR OF SOILS Ph.D. Thesis
Gary Gwo-Fea Luh 1980 148 p
Avail: Univ. Microfilms Order No. 8106513

The dynamic response of a large number of uniform-sized, dry sands and a limited number of improved gradations was obtained from resonant column tests, and the data were analyzed to evaluate the effects of grain characteristics (size, gradation, shape, surface texture) and other test variables (e.g., ambient stress conditions, void radio or relative density, strain amplitude, number of loading cycleis) on the modulus and damping capacity. For strain amplitudes less than 0.002 radians, results indicate that mean principal stress, density, and strain amplitude exert the strongest influence on both the modulus and damping capacity. Shear modulus is further influenced by grain roundness; the effects of the other parameters are either virtually zero or very small. Empirical relationships correlating shear modulus and damping capacity to the important controlling parameters were obtained. Dissert. Abstr.

N81-26292 Michigan State Univ., East Lansing.
THE DEVELOPMENT AND EVALUATION OF ACCIDENT PREDICTIVE MODELS Ph.D. Thesis
Thomas Lewis Maleck 1980 564 p
Avail: Univ. Microfilms Order No. 8112121

A mathematical model that will predict the incremental change in the dependent variables (accident types) resulting from changes in the independent variables is developed. The end product is a tool for estimating the expected number and type of accidents for a given highway segment. The data segments (accidents) are separated in exclusive groups via a branching process and variance is further reduced using stepwise multiple regression. The standard error of the estimate is calculated for each model. The dependent variables are the frequency, density, and rate of 18 types of accidents among the independent variables are: district, county, highway geometry, land use, type of zone, speed limit, signal code, type of intersection, number of intersection legs, number of turn lanes, left-turn control, all-red interval, average daily traffic, and outlier code. Models for nonintersectional accidents did not fit nor validate as well as models for intersectional accidents. Dissert. Abstr.

N81-26293# Army Construction Engineering Research Lab., Champaign, Ill.
BUILDING LOADS ANALYSIS AND SYSTEM THERMODYNAMICS (BLAST) PROGRAM USERS MANUAL VOLUME 1: SUPPLEMENT (VERSION 3.0) Final Report
Dale Herron, George Walton, and Linda Lawrie Mar. 1981 119 p refs Supplement to CERL-TR-E-153-Vol-1 and CERL-TR-E-153-Vol-2
(Contracts MIPR-FY7615-79-05134; DE-AI01-79CS-30301)
(AD-A099054; CERL-TR-E-171-Vol-1-Suppl) Avail: NTIS HC A06/MF A01 CSCL 09/2

BLAST Version 3.0 can be used to model passive solar applications and to analyze large-scale industrial facilities. Parameters, users can study with BLAST Version 3.0 (in addition to BLAST 2.0 capabilities) include (1) interzone heat transfer and ventilation, (2) movable insulation, (3) daylighting, (4) exact internal solar distribution, (5) radiant temperature control, (6) exterior radiant interchange, (7) mechanical ventilation, (8) process heat as heat source, (9) latent air-to-air heat recovery, (10) water-cooled packaged systems, (11) induction unit systems, (12) direct-drive chillers, and (13) purchased steam from utilities. BLAST version 3.0 also offers the user a generalized report writer and several new output report options not available from BLAST Version 2.0. Although the simulation capabilities of BLAST Version 3.0 are expanded over BLAST Version 2.0, users familiar with BLAST Version 2.0 can use Version 3.0 without modifying their approach or their BLAST input. GRA

N81-26294# Department of Energy, Washington, D. C. Residential and Commercial Data Systems Div.
NONRESIDENTIAL BUILDINGS ENERGY CONSUMPTION SURVEY: BUILDING CHARACTERISTICS
Mar. 1981 160 p
(DOE/EIA-0246) Avail: NTIS HC A08/MF A01

Data on the characteristics of nonresidential buildings in the 48 contiguous States and the District of Columbia are presented. The information was collected through personal interviews conducted with building representatives. A summary of the survey design, data collection procedures, and techniques used to convert the sample data to national estimates is given. Estimated counts and percent distributions are presented by building type for selected building characteristics. These building characteristics include: location; structural features; use and occupancy characteristics; types of fuels coming into the building. The same building characteristics are given for all nonresidential buildings by square footage and year of construction. DOE

N81-26295# National Bureau of Standards, Washington, D.C.
NONDESTRUCTIVE EVALUATION METHODS FOR QUALITY ACCEPTANCE OF HARDENED CONCRETE
James R. Clifton and Erik D. Anderson Jan. 1981 55 p refs
(PB81-159618; NBSIR-80-2163) Avail: NTIS HC A04/MF A01 CSCL 13C

Nondestructive test methods which can be used in quality acceptance programs for hardened concrete is critically reviewed and described. These include techniques which provide information on the strength, quality and uniformity, thickness, air content, stiffness, finish, density of concrete as well as the location and condition of steel reinforcement. Both commonly used methods and possible test methods are covered. In addition, the feasibility of combining two or more test methods for improving the prediction of the strength or quality of concrete is explored.GRA

N81-26296# Louisiana Dept. of Transportation and Development, Baton Rouge. Research and Development Section.
EFFECTS OF ASPHALT CEMENT REJUVENATING AGENTS Final Report, Jul. 1977 - May 1980
Donald E. Carey and Harold R. Paul Aug. 1980 46 p ref
(PB81-159568; LA-78-1B(B); RR-146; FHWA/LA-80/140)

Avail: NTIS HC A03/MF A01 CSCL 13C

Rejuvenating agents are examined with regard to the effect of the rejuvenator at various levels of addition, upon age hardened asphalts, the aging characteristics of the rejuvenated asphalts, and the uniformity of mixing of the rejuvenating agents with asphaltic concrete mixes. Prediction equations yielding the proper quantity of rejuvenator to be added to an oxidized asphalt were examined. The rejuvenated asphalts followed anticipated patterns when tested for penetration, viscosity, and ductility. The rejuvenated asphalts demonstrated acceptable viscosity indices when subjected to the Thin Film Oven Test. Testing for uniformity of mixing in asphaltic concrete mixes proved inconclusive. GRA

N81-26297# Colorado Div. of Highways, Denver.
SOLAR POWERED HIGHWAY SIGN Final Report
Robert L. Hayden and Werner Hutter Sep. 1980 59 p refs Sponsored in part by Federal Highway Administration, Washington Prepared by Colorado Div. of Highways
(PB81-160004; CDOH-DTP-R-80-9; FHWA/CO/RD-80/9) Avail: NTIS HC A04/MF A01 CSCL 13B

A roadside sign was equipped with lights powered by photovoltaic solar panels to improve nighttime visibility and evaluate equipment performance and needs. The photovoltaic panels were found to be reliable and effective for powering flashing lights on a highway warning sign. Cost of the panels is high so their use should be limited to locations where commercial electrical power is not available. Solar electric systems should be carefully designed to minimize costs and produce a reliable system. Sufficient prediction for the solar panels should be provided in areas where theft or vandalism might be a problem. GRA

N81-26298# Nebraska State Dept. of Roads, Lincoln. Materials and Tests Div.
FLEXIBLE PAVEMENT PERFORMANCE EVALUATION USING DEFLECTION CRITERIA Final Report
R. J. Wedner Apr. 1980 121 p Prepared in cooperation with the Federal Highway Administration
(PB81-158958; RESEARCH-STUDY-73-4; FHWA-RD-81-S01071; R80-2(536)) Avail: NTIS HC A06/MF A01 CSCL 13B

Flexible pavement projects in Nebraska were monitored for dynamic deflections, roughness, and distress for six consecutive years. Present surface conditions were characterized and data for evaluating rehabilitation needs, including amount of overlay, were provided. Data were evaluated and factors were isolated for determining the structural adequacy of flexible pavements, evaluating existing pavement strength and soil subgrade conditions, and determining overlay thickness requirements. Terms for evaluating structural condition for pavement sufficiently ratings were developed and existing soil support value and subgrade strength province maps were evaluated. GRA

N81-26299# Dames and Moore, Washington, D. C.
NEW STRUCTURAL SYSTEMS FOR ZERO-MAINTENANCE PAVEMENTS. VOLUME 1: ANALYTICAL AND EXPERIMENTAL STUDIES OF AN ANCHORED PAVEMENT. A CANDIDATE ZERO-MAINTENANCE PAVEMENT Final Report, Jul. 1976 - Dec. 1979
S. K. Saxena, W. J. Rosenkranz, and S. G. Militsopoulos May 1980 241 p refs Prepared in cooperation with Illinois Inst. of Technology, Chicago 3 Vol.
(Contract DOT-FH-11-9114)
(PB81-157554; FHWA/RD-80/026-Vol-1) Avail: NTIS HC A11/MF A01; also available in set of 3 reports HC E16 as PB81-157547 CSCL 13B

The design feasibility and construction cost effectiveness of an anchored pavement concept for zero maintenance highways are investigated. An analytical model is designed to verify computer program results and to investigate construction methods for a full-scale highway section. A conventional slab and an anchored pavement in both continuous and jointed configurations were subjected to heat transfer, thermal stress, and mechanical stress analyses. The anchored pavement offers two distinct advantages over a conventional pavement. Deflections are lower and more uniform; and stresses in the soil are lower and distributed more widely by the rigid anchors. Three dimensional finite element analysis is considered to be the most efficient technique for examining the significance of environmentally induced stress. GRA

N81-26300# Dames and Moore, Washington, D. C.
NEW STRUCTURAL SYSTEMS FOR ZERO-MAINTENANCE PAVEMENTS. VOLUME 2: ANALYSIS OF ANCHORED PAVEMENTS USING ANSYS Final Report
S. K. Saxena and S. G. Militsopoulos Aug. 1980 148 p refs Prepared in cooperation with Illinois Inst. of Technology, Chicago 3 Vol.
(Contract DOT-FH-11-9114)
(PB81-157562; FHWA/RD-80/027-Vol-2) Avail: NTIS HC A07/MF A01; also available in set of 3 reports HC E16 as PB81-157547 CSCL 13B

A set of procedures to evaluate the response of an anchored pavement subjected to vehicle static loads, moisture variation in the subgrade, and/or temperature variation through the surface of the pavement is presented. These procedures include two computer programs known as FEMESH and ANSYS. The FEMESH program generates rectangular meshes in either a two or three dimensional coordinate system for any prespecified number and spacing of nodes. The ANSYS program evaluates the stresses, strains, and the deflections at all elements in each material included in the analytical model. GRA

N81-26301# Dames and Moore, Washington, D. C.
NEW STRUCTURAL SYSTEMS FOR ZERO-MAINTENANCE PAVEMENTS. VOLUME 3: ANCHORED PAVEMENT SYSTEM DESIGNED FOR EDENS EXPRESSWAY Final Report
S. K. Saxena and S. G. Militsopoulos Aug. 1980 124 p refs Prepared in cooperation with Illinois Inst. of Technology, Chicago 3 Vol.
(PB81-157570; FHWA/RD-80/028-Vol-3) Avail: NTIS HC A06/MF A01; also available in set of 3 reports HC E16 as PB81-157547 CSCL 13B

The response of the Edens Expressway subjected to mechanical and environmental loads using the anchored pavement concept is discussed. The mechanical and thermal properties of materials that could be encountered in future reconstruction of Edens Expressway are presented in a consistent form for computer programming. These properties are viewed as typical design values during investigation of pavement response. The behavior of the anchored pavement under induced temperature loads and weakening of subgrade (by thawing action) is clearly demonstrated. The example problem provides the input parameters of materials and loads for the analysis, the generation of finite element mesh, and the results of the analysis. GRA

N81-26302# Factory Mutual Research Corp., Norwood, Mass.
SPRINKLER PERFORMANCE IN RESIDENTIAL FIRE TESTS
Hsiang-Cheng Kung, Robert D. Spaulding, and Richard Hill, Jr. Jul. 1980 183 p refs
(Grant NFPCA-76054)
(PB81-165409; FEMA/FA-41) Avail: NTIS HC A09/MF A01 CSCL 13M

Three series of tests were conducted: (1) nonventilated fires (bedroom, small bedroom, and living room); (2) ventilated living room fires with noncombustible walls and ceiling; and (3) ventilated living room fires with combustible walls and ceiling. In the ventilated living room fire tests with noncombustible walls and ceiling, it was demonstrated that by increasing link sensitivity, less water was required to control the fire. In the ventilated living room fire tests with combustible walls and ceiling, the fire was fast developing and highly challenging. Adequate water application to the corner of the room, where the fire source was located, and to the walls was found to be critical in controlling such a fire. GRA

N81-26303# California Univ., San Diego. Dept. of Applied Mechanics and Engineering Sciences.
SEISMIC STABILITY OF BLOCK STRUCTURES
Richard L. Furgerson May 1980 104 p refs
(Grant NSF PFR-78-16581)
(PB81-158578; UCSD/AMES/TR-80/002) Avail: NTIS HC A05/MF A01 CSCL 13M

A structural stability problem involving a rigid body shear wall floor slab configuration with Coulomb friction acting between the vertical and horizontal elements is solved numerically. Hazard from collapse due to kinetic instability is inversely proportional to the time the assemblage can withstand excitation before collapsing. Statistical analysis of data gives an asymptotic Coulomb law describing this friction. A well defined relation between the maximum amplitude of excitation, natural frequency of the structure, and hazard from kinetic instability is demonstrated. Graphical representation permits assessment of hazard from kinetic structural instability by inspection. GRA

N81-26304# California Univ., Berkeley. Earthquake Engineering Research Center.
EXPERIMENTAL TESTING OF A FRICTION DAMPED ASEISMIC BASE ISOLATION SYSTEM WITH FAIL-SAFE CHARACTERISTICS
James M. Kelly, Karl E. Beucke, and Mark S. Skinner Jul. 1980 62 p refs
(Grant NSF PFR-79-08257)
(PB81-148595; UCB/EERC-80/18) Avail: NTIS HC A04/MF A01 CSCL 13M

An experimental study of a Coulomb friction damped aseismic base isolation system with fail-safe characteristics is described. The base isolation system utilized commercially made natural rubber bearings and a skid system which comes into operation at preset levels of relative horizontal displacement between the structure and the foundations. The fail-safe skid provides hysteretic damping and prevents failure of the isolation system in the event of displacements larger than those assumed in the original design. The isolation system can be designed for an earthquake which can be reasonably expected within the lifetime of the structure; in the event of an earthquake of unanticipated intensity the fail-safe system will prevent collapse of the structure. The implementation of the system in full scale structures poses no technical or construction problems. GRA

N81-26305# New Hampshire Univ., Durham. Marine Systems Engineering Lab.
RESEARCH AND ENGINEERING DESIGN OF A MICRO-COMPUTER CONTROLLED UNMANNED FREE SWIMMING VEHICLE Final Report, 1 Nov. 1979 - 31 Oct. 1980
Robert W. Corell Nov. 1980 157 p
(Contract DI-14-08-0001-18636)
(PB81-158420) Avail: NTIS HC A08/MF A01 CSCL 13J

The development of technology related to unmanned, untethered vehicles for offshore inspection purposes is described. Modification of the pipeline follower vehicle system from a mission of pipeline following to structural inspection is described. The command, control, communication, and navigation computer systems of the Experimental Autonomous Vehicle (EAVE) are described in detail. Flow charts and a navigation algorithm are presented. GRA

N81-26306# Kansas Univ., Lawrence.
MORTAR CONSTITUENT OF CONCRETE UNDER CYCLIC COMPRESSION
Ataullah Maher and David Darwin Oct. 1980 179 p refs
(Grants NSF ENG-76-09444; NSF CME-79-18414)
(PB81-164105; SM-5; NSF/RA-800322) Avail: NTIS HC A09/MF A01 CSCL 13C

The behavior of the mortar constituent of concrete under cyclic compression was studied and a simple analytic model was developed to represent its cyclic behavior. Experimental work consisted of monotonic and cyclic compressive loading of mortar. Two mixes were used, with proportions corresponding to concretes having water cement ratios of 0.5 and 0.6. Forty-four groups of specimens were tested at ages ranging from 5 to 70 days. complete monotonic and cyclic stress strain envelopes were obtained. A number of loading regimes were investigated, including cycles to a constant maximum strain. Major emphasis was placed on tests using relatively high stress cycles. Degradation was shown to be a continuous process and a function of both total strain and load history. No stability or fatigue limit was apparent. GRA

N81-26307# Transportation Research Board, Washington, D.C.
PROCEEDINGS OF THE NATIONAL SEMINAR ON ASPHALT PAVEMENT RECYCLING: TRANSPORTATION RESEARCH RECORD 780
1980 153 p refs
(PB81-162711; TRB/TRR-780; ISBN-0-309-03101-X; LC-80-607072) Avail: NTIS HC A08/MF A01; HC also available from Transportation Research Board, 2101 Constitution Ave., N.W., Washington, D.C. 20418 CSCL 13C

The economics of asphalt pavement recycling are presented. The costs, energy requirements, and specifications for project selection are discussed. Surface recycling is considered. The state of the art of both cold and hot recycling is presented, and equipment needs are discussed. The method of hot urban recycling used in Denver, Colorado, is reviewed. Special consideration is given to the differing requirements and circumstances of recycling under rural and urban conditions. Quality control of recycled asphalt concrete mixtures is discussed. Air pollution control for asphalt pavement recycling is considered. J.D.H.

N81-26308# Wiggins (J. H.) Co., Redondo Beach, Calif.
ASSESSMENT OF DAMAGEABILITY FOR EXISTING BUILDINGS IN A NATURAL HAZARDS ENVIRONMENT. VOLUME 1: METHODOLOGY
T. K. Hasselman, Ronald T. Eguchi, and John H. Wiggins Sep. 1980 197 p refs 2 Vol.
(Grant NSF ENV-77-19342)
(PB81-165300; TR-80-1332-1) Avail: NTIS HC A09/MF A01 CSCL 13M

A computer tool was developed for local building and safety officials so that they may independently assess the damageability of individual buildings exposed to earthquakes, severe winds, and tornado forces. The computer program, named DAMAGE, includes the following features: (1) it combines the calculation of environmental with dynamic response analysis and damage modeling to evaluate both the structural and nonstructural damage potential of existing and newly designed buildings on a story by story basis; (2) it uses an interpretive format keyed to interstory drift; (3) it contains user-oriented instructions and guidelines with examples developed during actual user testing. Volume 1 describes the development of interstory drift as a basis for measuring building performance in earthquake and wind environments. GRA

N81-26309# Wiggins (J. H.) Co., Redondo Beach, Calif.
ASSESSMENT OF DAMAGEABILITY FOR EXISTING BUILDINGS IN A NATURAL HAZARDS ENVIRONMENT. VOLUME 2: DAMAGE COMPUTER PROGRAM USERS MANUAL
T. K. Hasselman, Shwu-jen Hong Chen, Ronald T. Eguchi, and John H. Wiggins Sep. 1980 152 p refs 2 Vol.
(Grant NSF ENV-77-19342)
(PB81-165318; TR-80-1332-2) Avail: NTIS HC A08/MF A01 CSCL 13M

A new computer program for estimating the damage by floor for any type of building subjected to earthquake or wind loads is described. An original program provided a flexible tool for the analysis of these natural forces and their effect on specific buildings. Since this flexibility became a deterrent to practical use, the new program has incorporated several major changes. These are based on an investigation of the trade-offs between modeling detail and flexibility on one hand, and utility on the other, as they affect the primary output of the program structural response and damageability. A general overview of the damageability assessment procedure and the input instructions for the DAMAGE computer program is provided. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N81-26310 Illinois Univ. at Urbana-Champaign.
EFFECTS OF CROSS-CORRELATION INTERFERENCE ON AN OPTICAL CODE DIVISION MULTIPLE ACCESS

COMMUNICATION SYSTEM Ph.D. Thesis
George Dennis Peterson 1980 123 p
Avail: Univ. Microfilms Order No. 8108625

The effects of cross correlation interference and intensity fading on the error rate performance of an optical code division multiple access communication system were investigated. The analysis is for direct detection, optical polarization modulation systems. Performance is significantly dependent on the magnitude of the normalized second moment of the cross correlation between user codes and further analysis showed that the error probability decreases with increasing code length. The multiuse capabilities of the uplink and downlink channels differed significantly. Fading effects were analyzed by Nakagami m-distribution as a generalized statistical model of fluctuations in the received optical intensity. Numerical results are given for both severe and moderate lognormal fading, using the Nakagami m-distribution to approximate the lognormal distribution. It was shown that the downlink performs consistently better than the uplink under all of the fading conditions. It was shown that under lognormal fading, reasonable error rates for multiple users can be obtained by boosting the signal power in the uplink channel. Dissert. Abstr.

N81-26311 Texas Technological Univ., Lubbock.
ESTIMATION IN SIGNAL-DEPENDENT NOISE Ph.D. Thesis
Gary Karl Froehlich 1980 149 p
Avail: Univ. Microfilms Order No. 8111948

A measurement model incorporating signal dependent noise is investigated. The penalty for employing estimators that ignore the signal dependence is found in terms of bounds on the mean square estimation error (MSEE). The minimum achievable MSEE for any unbiased estimator based on the signal dependent noise model is derived. Estimators based on various optimality criteria are explored. The structure of these estimators is investigated for the specific case of signal dependent photographic film grain noise. Various suboptimal estimators are next explored. Computer simulations are then employed to compare the performance, in terms of MSEE, of all the estimators, as well as their sensitivity to variations in certain parameters. The model is generalized to the vector case. Joint maximum likelihood and joint maximum a posterion probability estimates are derived. The state space approach is formulated, and the inapplicability of the traditional Kalman-Buoy filter is discussed. Dissert. Abstr.

N81-26312 Brown Univ., Providence, R. I.
COLLISIONS OF SOLITARY WAVES Ph.D. Thesis
Rida Mostafa Mirie 1980 129 p
Avail: Univ. Microfilms Order No. 8111148

A perturbation treatment of the head on collision of surface solitary waves which reveals a third order feature, the emerging solitary waves are tilted backward to the direction of their propagation is presented. A slow time evolution of a tilted solitary wave shows that the wave evolves into a trainwave trailing a symmetric solitary wave. The numerical treatment of the reflection of a solitary wave from a vertical wall demonstrates the nonsymmetry in time of the collision and describes the collision of the wavetrain produced with the wall. It also confirms that the reflected solitary wave coincides with the profile of the incident solitary wave. The maximum run up during the collision, and the phase shift in the reflected wave are obtained in both treatments. The two fluid system, and several sets of equations are also presented. The second order perturbation solution of the propagation of a solitary wave at the interface was obtained. Dissert. Abstr.

N81-26313 Cornell Univ., Ithaca, N. Y.
SINGLE AND COUPLED TRANSMISSION LINE MODELS OF OPEN DIELECTRIC WAVEGUIDES Ph.D. Thesis
Jeffrey Clyde Hantgan 1981 173 p
Avail: Univ. Microfilms Order No. 8110906

A general procedure is outlined for obtaining single or coupled transmission line models to represent the propagation of surface wave modes in open dielectric waveguides. The procedure uses a homogeneous electrically or magnetically walled waveguide having the same dimensions as the dielectric in the surface waveguide to produce a set of orthogonal eigenfunctions. These eigenfunctions are then projected upon Maxwell's equations resulting in a system of transmission lines coupled together through a wave immittance. This wave immittance represents the ratio of a longitudinal and a transverse field component in the surface waveguide at the dielectric-air interface. Dissert. Abstr.

N81-26314 Texas Univ. at Arlington.
AN ADAPTIVE DPCM SYSTEM FOR NTSC COMPOSITE VIDEO SIGNALS Ph.D. Thesis
Norman Roy Cox 1980 250 p
Avail: Univ. Microfilms Order No. 8111702

An adaptive DPCM algorithm is proposed for effectively encoding digitized NTSC color video signals. This algorithm essentially predicts picture contours in the composite signal without resorting to component separation. The contour parameters are first optimized using four typical television frames that were sampled at three times the color subcarrier frequency. Three variations of the basic predictor are simulated and compared quantitatively with three nonadaptive predictors of similar complexity. A suitable coding scheme is selected and several preliminary quantizers are designed. A flexible encoder/simulator made it possible to evaluate the contour predictor in real time under a variety of conditions. The procedures used for conducting both subjective and objective tests are given along with an interpretation of their results. Based upon the findings, a complete coder/decoder (codec) system is proposed. Dissert. Abstr.

N81-26315*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
THE 30/20 GIGAHERTZ TRANSPONDER STUDY Final Report
Dec. 1980 114 p refs
(Contract NAS3-21508)
(NASA-CR-165295) Avail: NTIS HC A06/MF A01 CSCL 17B

Design features and performance parameters are described for three types of wideband multiple channel satellite transponders for use in a 30/20 GHz communications satellite, which provides high data rate trunking service to ten ground station terminals. The three types of transponder are frequency division multiplex (FDM), time division multiplex (TDM), and a hybrid transponder using a combination of FDM and TDM techniques. The wideband multiple beam trunking concept, the traffic distribution between the trunking terminals, and system design constraints are discussed. The receiver front end design, the frequency conversion scheme, and the local oscillator design are described including the thermal interface between the transponders and the satellite. The three designs are compared with regard to performance, weight, power, cost and initial technology. Simplified block diagrams of the baseline transponder designs are included.
A.R.H.

N81-26316# Institute for Telecommunication Sciences, Boulder, Colo.
A CONSOLIDATED MODEL FOR UHF/SHF TELECOMMUNICATION LINKS BETWEEN EARTH AND SYNCHRONOUS SATELLITES
H. T. Dougherty Aug. 1980 92 p refs
(PB81-161150; NTIA/REPT-80-45) Avail: NTIS HC A05/MF A01 CSCL 17B

The radio wave propagation path between an Earth station and a synchronous satellite is described. This UHF/SHF consolidated model, adaptable for subsequent updating, includes state of the art estimates of noise, attenuation, depolarization and turbulence. The role of system geometry in signal depolarization is presented and the basis for the evaluation of linear versus circular polarization is developed. The conventional figures of merit are included; the determination of service fields (desired signal levels) and potential interference fields (undesired signal levels) are described. GRA

N81-26317*# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
A 12 GHz SATELLITE VIDEO RECEIVER: LOW NOISE, LOW COST PROTOTYPE MODEL FOR TV RECEPTION FROM BROADCAST SATELLITES Final Report, Jan. 1978 - Feb. 1979
M. A. Hreha, J. G. Baprawski, C. N. Chamaneria, S. J. Ferry, G. Keithly, H. S. Kuklin, W. H. Lockyear, L. H. Schifter, N. E.

Swanberg, G. W. Swift et al Dec. 1978 72 p refs (Contract NAS5-24421)
(NASA-CR-160019; W-42953) Avail: NTIS HC A04/MF A01 CSCL 17B

A 12-channel synchronous phase lock video receiver consisting of an outdoor downconverter unit and an indoor demodulator unit was developed to provide both low noise performance and low cost in production quantities of 1000 units. The prototype receiver can be mass produced at a cost under $1540 without sacrificing system performance. The receiver also has the capability of selecting any of the twelve assigned satellite broadcast channels in the frequency range 11.7 to 12.2 GHz.
A.R.H.

N81-26318# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Forschungsbereich Nachrictentechnik und Erkundung.
CONTRIBUTIONS TO THE COLLOQUIUM ON HIGH FREQUENCY TECHNOLOGY IN AEROSPACE RESEARCH
Jun. 1980 118 p refs In GERMAN; ENGLISH summary Colloquium held at Oberpfaffenhofen, West Germany, 23 Jun. 1980 Report will also be announced as translation (ESA-TT-704)
(DFVLR-Mitt-80-10) Avail: NTIS HC A06/MF A01

The application of radio technology to space exploration and communication is assessed. Communication techniques for terrestrial problems and space missions, for navigation and tracking systems, and microwave remote sensing as well as solar plasma measurements are addressed. Several Spacelab payloads are discussed including one on remote sensing and one on communications and nab navigation studies. For individual titles, see N81-26319 through N81-26326.

N81-26319# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Forschungsbereich Nachrichtentechnik und Erkundung.
DOCTOR G. ULBRICHT AS A SCIENTIST AND A MAN: A EULOGY [PROF. DR.-ING. G. ULBRICHT ALS WISSENSCHAFTER UND MENSCH EINE WUERDIGUNG]
Heinz Haeberle *In its* Contrib. to the Colloq. on High Frequency Technol. in Aerospace Res. Jun. 1980 p 7-11 In GERMAN (For primary document see N81-26318 17-32)
Avail: NTIS HC A06/MF A01

The career of Dr. Guenther Ulbricht, professor of engineering, is recounted, and his many professional accomplishments are praised. On May 12, 1980 he celebrated his 75th birthday.
Author (ESA)

N81-26320# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
CURRENT RADIO FREQUENCY TECHNIQUES IN AEROSPACE RESEARCH
Wolfgang Keydel *In its* Contrib. to the Colloq. on High Frequency Technol. In Aerospace Res. Jun. 1980 p 13-26 refs In GERMAN; ENGLISH summary (For primary document see N81-26318 17-32)
Avail: NTIS HC A06/MF A01

Two aspects of radio frequency technology in aviation and space systems engineering are considered, i.e., interference phenomena and antenna design. Multipath problems and the dimensioning of a seeking antenna for an antiaircraft missile are cited as examples. Multipath effects cause fading in communication channels and angle errors in tracking radars. Measured results of fading in a satellite communication link and of the image effect observed with a radar tracking a target flying over water are presented. Computation of possible angle errors in a monopulse radar is demonstrated. The design of a seeking antenna with respect to system requirements for an antiaircraft missile is illustrated. Relations between antenna parameters and missile flight parameters are derived from proportional navigation conditions.
Author (ESA)

N81-26321# Technische Universitaet, Munich (West Germany). Inst. fuer Luft- und Raumfahrt.
DEEP SPACE MISSION: REVIEW AND OUTLOOK
Philip Hartl *In* DFVLR Contrib. to the Colloq. on High Frequency Technol. in Aerospace Res. Jun. 1980 p 27-43 refs In GERMAN; ENGLISH summary (For primary document see N81-26318 17-32)
Avail: NTIS HC A06/MF A01

Deep space missions conducted during the 1970's are reviewed and compared. Data transmission rates and accuracy in position determination are emphasized. The Deep Space Network is briefly described. Missions discussed include Helios, Pioneer, Viking, Pioneer Venus, and Voyager 1 and 2. Missions planned for the 1980's are considered. These are Galileo, the International Solar Polar Mission, and Giotto (Comet Halley Flyby). The potential for interstellar missions is also discussed.
Author (ESA)

N81-26322# Ruhr Univ., Bochum (West Germany). Inst. fuer Hoch- und Hoechstfrequenztechnik.
HYDROMAGNETIC WAVES IN THE SOLAR PLASMA AS INFERRED FROM HELIOS REMOTE SENSING DATA
Peter Edenhofer *In* DFVLR Contrib. to the Colloq. on High Frequency Technol. in Aerospace Res. Jun. 1980 p 45-54 refs In GERMAN; ENGLISH summary (For primary document see N81-26318 17-32)
Avail: NTIS HC A06/MF A01

The fine structure of periodicity during solar occultations is inferred from the temporal variations of columnar electron content measurements made by the Helios space probes. A maximum entropy spectral analysis reveals significant frequency peaks within the range 0.2 to 3 mHz. A comparison with Helios Faraday rotation measurements indicates hydromagnetic waves. This can be regarded as experimental evidence that such waves exist in the solar corona with a typical fundamental period of 1 hr.
Author (ESA)

N81-26323# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
PROBLEMS IN MOBILE COMMUNICATION VIA SATELLITES [PROBLEME MOBILIER SATELLITENKOMMUNIKATION]
Herwig Oettl *In its* Contrib. to the Colloq. on High Frequency Technol. in Aerospace Res. Jun. 1980 p 55-70 refs In GERMAN (For primary document see N81-26318 17-32)
Avail: NTIS HC A06/MF A01

Three aspects of satellite communication with mobile ground stations are examined: satellite transmission efficiency, suitable equipment for mobile units, and transmission media characteristics. Possibilities for large geostationary satellite structures, e.g., the Public Service Platform, a multibeam antenna, are considered. The equipment used for the German Experimental Ship Terminal is discussed. Transmission measurement results (1.5 GHz) at low elevation angles are emphasized. Atmospheric influences, multipath effects, and signal fading are analyzed for transmissions via ATS-6 and Marisat satellites.
Author (ESA)

N81-26324# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
A MICROWAVE REMOTE SENSING EXPERIMENT (MRSE) ONBOARD SPACELAB [DAS MRSE (MICROWAVE REMOTE SENSING EXPERIMENT), EIN MIKROWELLEN-FERNERKUNDUNGSEXPERIMENT IM SPACELAB]
Marian Werner *In its* Contrib. to the Colloq. on High Frequency Technol. in Aerospace Res. Jun. 1980 p 71-79 In GERMAN (For primary document see N81-26318 17-32)
Avail: NTIS HC A06/MF A01

The MRSE design and development are discussed. The equipment allows for three operating modes: scatterometry, synthetic aperture radar, and microwave radiometry. Sea state measurement, radar imagery, and passive detection of terrestrial radiation are planned.
Author (ESA)

N81-26325# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
A COMMUNICATIONS AND NAVIGATION EXPERIMENTS PACKAGE (COMNAV) FOR SPACE SHUTTLE MISSIONS [EIN NUTZLASTELEMENT MIT KOMMUNIKATIONS- UND NAVIGATIONSEXPERIMENTEN FUER SPACE-SHUTTLE-MISSIONEN]

Horst Goessl, Max Fey, David Hounam, and Peter Sliwinski *In its* Contrib. to the Colloq. on High Frequency Technol. in Aerospace Res. Jun. 1980 p 81-96 refs In GERMAN; ENGLISH summary (For primary document see N81-26318 17-32)
Avail: NTIS HC A06/MF A01

The specification of a package of communications and navigation experiments, intended as part of the Spacelab D1 payload, is summarized. The COMNAV facility corresponds to a minimum configuration of the onboard instrumentation. This configuration enables six of the proposed experiments to be performed in L band. The payload features modular construction and can be extended to include experiments operating in the 30 GHz range. It is largely independent of Spacelab, so that few modifications are necessary if the payload is to be flown on a shuttle-only mission. Examples are also given of what general conditions must be met so that COMNAV experiments can be combined with other spaceborne experiments. Author (ESA)

N81-26326# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
THE STATE OF DEVELOPMENT OF RADIO NAVIGATION IN SPACE TRAVEL [DER ENTWICKLUNGSSTAND DER FUNKORTUNG IN DER RAUMFAHRT]
Siegfried Starker *In its* Contrib. to the Colloq. on High Frequency Technol. in Aerospace Res. Jun. 1980 p 97-117 In GERMAN (For primary document see N81-26318 17-32)
Avail: NTIS HC A06/MF A01

The development of navigation and positioning technology is assessed, while those areas in which advances are most urgently needed are identified. A state-of-the-art flow model, showing the mutual influence of different research endeavors as well as their impact on future research goals, is presented. Positioning and navigation, using satellite networks or satellite-borne systems, are then considered. The application of recently developed electronic equipment, such as microprocessors and minicomputers, is mentioned. Terrestrial surface navigation capabilities are also discussed as a spin-off of spaceborne remote sensing activities. Author (ESA)

N81-26327# Fondazione Ugo Bordoni, Rome (Italy).
EFFECTS OF THE LOWER ATMOSPHERE ON RADIO PROPAGATION AT FREQUENCIES ABOVE 1GHz
1980 95 p refs Presented at U.R.S.I. Symp., Lennoxville, Canada, 26-30 May 1980
(FUB-22-1980) Avail: NTIS HC A05/MF A01

The rain-induced attenuation of microwave transmission is examined. Rainfall intensity statistical properties and attenuation prediction techniques are discussed for both terrestrial and Earth-satellite transmission cases. For individual titles, see N81-26328 through N81-26335.

N81-26328# Fondazione Ugo Bordoni, Rome (Italy).
PREDICTION OF ATTENUATION DUE TO RAINFALL ON TERRESTRIAL LINKS
Francesco Fedi *In its* Effects of the Lower Atmosphere on Radio Propagation at Frequencies Above 1GHz 1980 p 6-35 refs (For primary document see N81-26327 17-32)
Avail: NTIS HC A05/MF A01

Rain attenuation and its influence on the availability of terrestrial radio communication systems operating at frequencies above 10 GHz are discussed. The availability objectives recently established for digital systems, the information necessary, and a calculation procedure applicable for system design are examined. Various methods for predicting attenuation due to rain are compared and reviewed. Present trends in the use of frequencies above 10 GHz in terrestrial systems are illustrated and areas in which further study is needed are indicated. Author (ESA)

N81-26329# Fondazione Ugo Bordoni, Rome (Italy).
RAINFALL INTENSITY, STATISTICAL PROPERTIES, AND PREDICTION TECHNIQUES
F. Barbaliscia and F. Fedi *In its* Effects of the Lower Atmosphere on Radio Propagation at Frequencies Above 1GHz 1980 p 37-44 refs (For primary document see N81-26327 17-32)
Avail: NTIS HC A05/MF A01

Results derived from the analysis of rainfall intensity data obtained with rapid response raingages and acquisition systems are presented. The characterization of the various climatic zones and year to year variability are examined together with statistical properties of rainfall intensity, such as distributions of the exceedance time durations and the relationship between yearly and worst month statistics. The possibility of predicting statistics of rainfall intensity on the basis of data obtained with standard procedures by meteorological services is also discussed. Author (ESA)

N81-26330# Fondazione Ugo Bordoni, Rome (Italy).
FREQUENCY SCALING OF RAIN INDUCED ATTENUATION AT 11, 18 AND 30 GHz
F. Barbaliscia, F. Fedi, D. Maggiori, and P. Migliorini *In its* Effects of the Lower Atmosphere on Radio Propagation at Frequencies Above 1GHz 1980 p 45-52 ref (For primary document see N81-26327 17-32)
Avail: NTIS HC A05/MF A01

Results obtained from a preliminary analysis of rain attenuation data, simultaneously measured at 11, 18 and 30 GHz on the same 10 Km terrestrial link, are presented. A frequency scaling technique to derive rain induced attenuation statistics at higher frequencies on the basis of the available data obtained at lower frequencies both for terrestrial and Earth-satellite radio links is described. Author (ESA)

N81-26331# Fondazione Ugo Bordoni, Rome (Italy).
A SYSTEMATIC COMPARISON OF RAIN ATTENUATION PREDICTION METHODS FOR TERRESTRIAL PATHS
E. Damosso (Centro Studi e Lab. Telecomunicazioni), G. DeRenzis (Centro Studi e Lab. Telecomunicazioni), F. Fedi, and P. Migliorini *In its* Effects of the Lower Atmosphere on Radio Propagation at Frequencies Above 1GHz 1980 p 53-62 refs (For primary document see N81-26327 17-32)
Avail: NTIS HC A05/MF A01

The available rain attenuation prediction methods are tested and compared, and the sensitivity to various input parameters regarding both the rain structure and the rainfall intensity measuring and processing techniques are examined, on the basis of rain data collected in the northern and central parts of Italy. Starting from the same data, the relationships between worst month/yearly cumulative rain attenuation distributions, and the diurnal influence on them are given. The rain rate integration time method is found to be most suitable for predictions, although it seems to be quite sensitive to rainfall intensity measuring techniques. Author (ESA)

N81-26332# Fondazione Ugo Bordoni, Rome (Italy).
AN ANALYTICAL METHOD TO EVALUATE THE EFFECT OF MULTIPATH FADING ON LONG-HAUL HIGH-CAPACITY DIGITAL RADIO RELAY SYSTEMS
F. Andreucci, F. Fedi, and P. G. Marchetti *In its* Effects of the Lower Atmosphere on Radio Propagation at Frequencies Above 1GHz 1980 p 63-71 refs (For primary document see N81-26327 17-32)
Avail: NTIS HC A05/MF A01

A method which evaluates error probability due to multipath selective fading is proposed, and taking into account the system fading margin, the outage probability is calculated for digital radio relay links. A single echo transfer function of the transmission channel is used, depending on the amplitude and delay parameters. Outage probability calculations were made in a 11 GHz, 140 Mbit/sec, 4 PSK and 8 PSK digital system. It is shown that outage probability is much higher than that due to nonselective fading. Author (ESA)

N81-26333# Fondazione Ugo Bordoni, Rome (Italy).
RAIN ATTENUATION ON EARTH-SATELLITE LINKS: A PREDICTION METHOD BASED ON POINT RAINFALL INTENSITY STATISTICS
F. Fedi *In its* Effects of the Lower Atmosphere on Radio Propagation at Frequencies Above 1GHz 1980 p 73-80 refs (For primary document see N81-26327 17-32)
Avail: NTIS HC A05/MF A01

Prediction of rain induced attenuation statistics for Earth-satellite links from a knowledge of the point rainfall intensity cumulative distribution is studied. This method is an extension of a proven terrestrial links prediction method in which the vertical structure of rainfall is considered. The proposed method

was applied to five European locations for which reliable statistics on rainfall intensity and attenuation are available. In spite of rainfall model simplifications, it is shown that the proposed method gives results which are acceptable for Earth-satellite radiolinks at frequencies above 10 Ghz. Author (ESA)

N81-26334# Fondazione Ugo Bordoni, Rome (Italy).
A MODEL ORIENTED APPROACH TO MEASURING RAIN INDUCED CROSS-POLARIZATION
C. Capsoni (Polytech. of Milan), F. Fedi, D. Maggiori, and A. Paraboni (Polytech. of Milan) *In its* Effects of the Lower Atmosphere on Radio Propagation at Frequencies Above 1GHz 1980 p 81-86 refs (For primary document see N81-26327 17-32)
Avail: NTIS HC A05/MF A01

The advantages of the model oriented approach are discussed, and the various possible experimental configurations to identify and assess the models adopted for the depolarizing media are reviewed. Various experiments, i.e., one utilizing three independent polarizations and coherent detection, and another using one polarization and incoherent detection of co-polar and cross-polar signals, are examined. A three polarization system is recommended to avoid the introduction of assumptions regarding the media. A procedure for standardizing the presentation of crosspolarization data is suggested. Author (ESA)

N81-26335# Fondazione Ugo Bordoni, Rome (Italy).
RAINFALL SCATTER INTERFERENCE BETWEEN TERRESTRIAL AND SATELLITE RADIOLINKS
F. Barbaliscia, D. Maggiori, G. Mastrandrea, P. Migliorini, and A. Paraboni (Polytech. of Milan) *In its* Effects of the Lower Atmosphere on Radio Propagation at Frequencies Above 1GHz 1980 p 87-95 refs (For primary document see N81-26327 17-32)
Avail: NTIS HC A05/MF A01

Results obtained from the analysis of the most intense scatter events are presented together with a general description of the experimental setup. These interferences may be important in the case of frequency shaving between terrestrial and satellite links. A relatively low height of the common beam volume was chosen to assure the applicability of rainfall ground measurements. Statistical single and joint analysis were carried out and the results were compared with a theoretical model of the rain structure. The results are encouraging for further research on predicting coupling from rain intensity statistics. Author (ESA)

N81-26336# Naval Research Lab., Washington, D. C.
PRELIMINARY STUDY OF REJECTING TARGETLIKE INTERFERENCE IN RADAR Interim Report
B. H. Cantrell 11 May 1981 25 p refs
(AD-A098834; NRL-8472) Avail: NTIS HC A02/MF A01 CSCL 17/9

A means of detecting target echoes from targetlike interference in radars was studied. The procedure differed from the more conventional means of pulse-to-pulse coincidence detection by examining the fine structure of a single pulse. Two discriminants were postulated and their performance was evaluated using computer-generated data. The results look encouraging but because the fine structure which is sensitive to small changes is being used, real data are needed before the technique can be more fully assessed. Author (GRA)

N81-26337# Rome Air Development Center, Griffiss AFB, N.Y.
ELECTROMAGNETIC WAVE SCATTERING FROM ROUGH TERRAIN
Robert J. Papa, John F. Lennon, and Richard L. Taylor Sep. 1980 40 p refs
(AD-A098939; RADC-TR-80-300) Avail: NTIS HC A03/MF A01 CSCL 20/3

This report presents two aspects of a program designed to calculate electromagnetic scattering from rough terrain: (1) the use of statistical estimation techniques to determine topographic parameters and (2) the results of a single-roughness-scale scattering calculation based on those parameters, including comparison with experimental data. In the statistical part of the present calculation, digitized topographic maps are used to generate data bases for the required scattering cells. The application of estimation theory to the data leads to the specification of statistical parameters for each cell. The estimated parameters are then used in a hypothesis test to decide on a probability density function (PDF) that represents the height distribution in the cell. Initially, the formulation uses a single observation of the multivariate data. A subsequent approach involves multiple observations of the heights on a bivariate basis, and further refinements are being considered. The electromagnetic scattering analysis, the second topic, calculates the amount of specular and diffuse multipath power reaching a monopulse receiver from a pulsed beacon positioned over a rough Earth. The program allows for spatial inhomogeneities and multiple specular reflection points. The analysis of shadowing by the rough surface has been extended to the case where the surface heights are distributed exponentially. The calculated loss of boresight pointing accuracy attributable to diffuse multipath is then compared with the experimental results. The extent of the specular region, the use of localized height variations, and the effect of the azimuthal variation in power pattern are all assessed.
Author (GRA)

N81-26338# Rome Air Development Center, Griffiss AFB, N.Y.
THE REFLECTION PROPERTIES OF CONDUCTING SLABS
Paul A. Kossey and Edward A. Lewis Jan. 1981 42 p refs (AF Proj. 2305)
(AD-A098940; RADC-TR-80-371) Avail: NTIS HC A03/MF A01 CSCL 20/14

The exact monochromatic solution for the plane wave reflection by a flat homogeneous slab of arbitrary thickness and conductivity is written for both transverse magnetic (TM) and transverse electric (TE) polarizations. The reflected waveforms for an incident impulse and for a low frequency pulse are then written as Fourier integrals and are numerically solved for a number of special cases of interest for application of studies of the reflection properties and nature of the lowest regions of the daytime ionosphere. Author (GRA)

N81-26339# Rome Air Development Center, Hanscom AFB, Mass.
MODIFICATION OF THE AN/TRC-97A ANTENNA SYSTEM Final Report
William G. Mavroides and Ronald L. Fante Griffiss AFB, N.Y. Oct. 1980 34 p refs
(AF Proj. 4600)
(AD-A099016; RADC-TR-80-305) Avail: NTIS HC A03/MF A01 CSCL 09/5

This report presents the results of an analysis of the AN/TRC-97A tactical troporadio antenna to determine what possible sidelobe reduction can be attained. Theoretical results are presented on the effect of feed and sub reflector blockage on the radiation patterns. In addition, radiation patterns are included on a modified feed support structure of the existing system which results in improved sidelobes in the azimuth plane. Author (GRA)

N81-26340# Rome Air Development Center, Hanscom AFB, Mass.
SYNTHESIS OF ANTENNA PATTERNS WITH NULL CONSTRAINTS
Hans P. Steyskal Griffiss AFB, N.Y. Jan. 1981 26 p refs
(AF Proj. 2305)
(AD-A099078; RADC-TR-80-402) Avail: NTIS HC A03/MF A01 CSCL 09/5

The Gaussian antenna pattern synthesis method is extended to include constraints such as pattern nulls or pattern derivative nulls at a given set of angles. The problem is formulated as a constrained approximation problem which is solved exactly, and a clear geometrical interpretation of the solution is given in a multidimensional vector space. The relation of the present method to those of constrained gain-maximization and signal-noise ratio maximization is discussed and conditions for their equivalence stated. For a linear uniform N-element array, it is shown that when M nulls are imposed on a given 'quiescent' pattern, the optimum solution for the constrained pattern is the initial pattern and a set of M weighted (sin Nx)/sin x-beams. Each beam is centered exactly at the corresponding pattern null, irrespective of its relative location. In addition, simple quantitative expressions are derived for the pattern change and gain cost associated with the forced pattern nulls. Author (GRA)

N81-26341# Rome Air Development Center, Hanscom AFB, Mass.
NULL FILTER MOBILE RADAR (NFMRAD): CONCEPT VERIFICATION
W. Buchanan, H. Godlewski, and F. Sheppard Holt Griffiss AFB, N.Y. Oct. 1980 159 p refs
(AF Proj. 4600)
(AD-A099079; RADC-TR-80-306) Avail: NTIS HC A08/MF A01 CSCL 17/9

The Null Filter Mobile Radar (NFMRAD) concept is described, and the need for narrow-band digital filters that can distinguish between positive and negative frequencies is explained. Two different procedures for realizing complex bandpass and bandstop filters of the infinite impulse response type are described, and their properties evaluated. A procedure for generating complex bandpass and bandstop filters fo the finite impulse response type is also described, and the particular applicability of these filters to NFMRAD is discussed. The experimental NFMRAD system is described, and the field installation and test program is explained. A ground based experiment using a truck traveling at about 30 mph (13.4 m/s) as the radar platform is described. Under these experimental conditions, the performance of NFMRAD is computed theoretically and compared to expected performance of systems using Chebyshev and uniform-fed antenna arrays with and without filters. Real-time processing tasks such as antenna pattern synthesis, Doppler filtering, and detection processing are described. Hardware performance and a functional description of the radar hardware is presented. NFMRAD transmitter, receiver, and digital processing specification are reviewed, and experimental system restrictions are made clear. The NFMRAD system is found to have its greatest superiority over other systems for cases in which the differences between the radial velocities of the target and the local clutter is not large. Author (GRA)

N81-26342# National Oceanic and Atmospheric Administration, Norman, Okla. National Severe Storms Lab.
FAA RADARS AND THEIR DISPLAY OF SEVERE WEATHER (THUNDERSTORM) Final Report
Kenneth E. Wilk and J. T. Dooley Jul. 1980 44 p refs
(Contract DOT-FA77WAI-724)
(AD-A099383; FAA-RD-80-65) Avail: NTIS HC A03/MF A01 CSCL 04/2

The relative performances of FAA, ASR and ARSR Air Traffic Control radars are compared with the WSR-57 weather radar using simple models of time dependent reflectivity profiles from severe thunderstorms. Results show the relatively wide vertical beams of FAA radars are helpful for early detection of new rain cells developing aloft. This better detection depends on range and is most useful within 65 n.mi. (120 km). Beyond 110 n.mi. (204 km), the FAA ARSR radars receive less returned signal and therefore underestimate storm strength more than the WSR-57, especially when the first heavy precipitation and hail have reached the ground. Because the FAA radar antennas are tilted and the beam axis is usually several degrees above the horizon, the return tends to maximize during storm development, but may decrease below severe weather indications while severe weather is occurring. GRA

N81-26343# Naval Research Lab., Washington, D. C.
RADAR-ESM CORRELATION DECISION PROCEDURE Interim Report
G. V. Trunk and J. O. Coleman 7 May 1981 16 p refs
(XF12151104)
(AD-A098842; NRL-8476) Avail: NTIS HC A02/MF A01 CSCL 09/2

The problem considered is how to correlate an ESM signal with one or none of m possible radar tracks when there are an unequal number of measurements associated with each radar track. It is suggested that the decision should be based on the probabilities of obtaining at least the measured squared-errors between the ESM measurements and each of the radar tracks. Using these probabilities, one of five possible decisions is made by comparing the largest probability to various thresholds and to the second largest probability. The accuracy of the method was investigated via computer simulations. GRA

N81-26344# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
PARAMETRIC INVESTIGATION OF RADOME ANALYSIS METHODS. VOLUME 1: SALIENT RESULTS Final Technical Report, 30 Sep. 1977 - 31 Dec. 1980
G. K. Huddleston, H. L. Bassett, and J. M. Newton Feb. 1981 96 p refs 4 Vol.
(Grant AF-AFOSR-3469-77; AF Proj. 2301)
(AD-A099181; AFOSR-81-0459TR-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 17/9

A general theory of radome analysis was developed and the accuracies and ranges of validity of three particular computer aided radome analysis methods were determined. Measured data are used as true data in assessing the accuracies of the computer codes. It is expected that the measured data obtained will be used in the future for similar purposes. It is also expected that the documented computer codes will serve as part of a technology base for use by researchers and practisioners in the radome technical community. GRA

N81-26345# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
PARAMETRIC INVESTIGATION OF RADOME ANALYSIS METHODS. VOLUME 2: COMPUTER-AIDED RADOME ANALYSIS USING GEOMETRICAL OPTICS AND LORENTZ RECIPROCITY Final Technical Report, 30 Sep. 1977 - 31 Dec. 1980
G. K. Huddleston, H. L. Bassett, and J. M. Newton Feb. 1981 326 p refs 4 Vol.
(Grant AF-AFOSR-3469-77; AF Proj. 2301)
(AD-A099182; AFOSR-81-0460TR-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 17/9

A FORTRAN computer program is described for computing the effects of a tangent ogive radome on the receiving patterns and boresight directions of a monopulse antenna. The analytical method based on ray tracing, main program, and 34 subroutines are thoroughly documented. Four test cases and their results in the form of printouts, pattern plots, and near-field graphs are presented. Author (GRA)

N81-26346# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
PARAMETRIC INVESTIGATION OF RADOME ANALYSIS METHODS. VOLUME 3: COMPUTER-AIDED RADOME ANALYSIS USING THE HUYGENS-FRESNEL PRINCIPLE Final Technical Report, 30 Sep. 1977 - 31 Dec. 1980
G. K. Huddleston, H. L. Bassett, and J. M. Newton Feb. 1981 133 p refs 4 Vol.
(Grant AF-AFOSR-3469-77; AF Proj. 2301)
(AD-A099183; AFOSR-81-0461TR-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 17/9

The effects of a tangent ogive radome on the receiving patterns and boresight directions of a monopule antenna are computed. A receiving formulation with the inside surface of the randome being the surface of integration is used. Aperture integration is used to compute the near fields of the antenna. The main program and seven subroutines are well documented. Author (GRA)

N81-26347# Aerospace Corp., El Segundo, Calif.
SIGNAL PROCESSING DISTORTION LOSS IN SPREAD-SPECTRUM COMMUNICATION, COMMAND, CONTROL, AND NAVIGATION SYSTEMS Final Report
A. C. Lytle, Jr. 1 Oct. 1980 210 p refs
(Contract F04701-80-C-0081)
(AD-A099187; TR-0081(6724-01)-1; SD-TR-81-20) Avail: NTIS HC A10/MF A01 CSCL 17/2

An integral equation for calculating exact signal processing loss in direct-sequence PSK-modulated, pseudonoise, spread spectrum digital transmission, caused by passband amplitude and/or phase distortion is derived in closed form. Methods for computer-assisted or manual means of evaluating the integral are worked out in several examples taken from operational satellite systems hardware. Procedures, design tables, and computer programs are provided for combinations of passband distortion and signal spectrum-weighting characteristics. Passband distortion specification and allocation is considered, analyzed, and discussed. Author (GRA)

N81-26348# Air Force Geophysics Lab., Hanscom AFB, Mass.
BCS-18A COMMAND DECODER-SELECTOR Final Report
Hans Laping 25 Aug. 1980 61 p refs
(AF Proj. 7659)
(AD-A099384; AFGL-TR-80-0249; AFGL-IP-289) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes an 18-channel command decoder-selector which operates in conjunction with an HF command receiver to allow secure and reliable radio control of high altitude balloon payloads. A detailed technical description and test results are also included. Author (GRA)

N81-26349# University of South Florida, Tampa. Dept. of Electrical Engineering.
INVESTIGATION OF LOW LEVEL AIRCRAFT NONAVIONIC NONLINEAR INTERFERENCE Phase Report, 1 Oct. 1979 - 30 Sep. 1980
J. L. Allen Griffiss AFB, N.Y. RADC Apr. 1981 52 p refs
(Contract F30602-78-C-0120; AF Proj. 2338)
(AD-A098784; RADC-TR-81-26) Avail: NTIS HC A04/MF A01 CSCL 20/14

High transmitter power levels combined with increased receiver sensitivity in multi-channel communication systems have led to operational problems caused by passively generated intermodulation products (IM). This report summarizes the results of a literature survey on causes, effects and reduction techniques for passively generated IM interference. An extensive list of references is included. Author (GRA)

N81-26350# Utah Univ., Salt Lake City. Dept. of Mathematics.
RADAR ECHO ANALYSIS BY THE SINGULARITY EXPANSION METHOD Technical Summary Report
Calvin H. Wilcox Jan. 1981 24 p refs
(Contract N00014-76-C-0276; NR Proj. 041-370)
(AD-A099224; TSR-41) Avail: NTIS HC A02/MF A01 CSCL 17/9

This paper presents an application of C. E. Baum's singularity expansion method (SEM) and the author's method of asymptotic wave functions to the prediction of pulse mode radar echoes from bounded scatterers. The results presented here are generalizations of corresponding results for sonar echoes. Only a summary of the principal concepts and results is presented here. A complete exposition of the theory is planned for a separate publication. Radar echo structure is analyzed under the following assumptions: the radar system (transmitter and receiver) operates in a stationary homogeneous isotropic unlimited medium; the system is stationary with respect to the medium; the scatterers are bounded perfectly conducting objects; the scatterers are stationary with respect to the medium; and the transmitter and receiver are in the far field of the scattering objects. In addition it is assumed that secondary echoes due to the radar system components are negligible. GRA

N81-26351# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FRAME-FILL TECHNIQUES FOR REDUCING VOCODER DATA RATES
Peter E. Blankenship and Marilyn L. Malpass 26 Feb. 1981 31 p refs
(Contract F19628-80-C-0002; AF Proj. 7820)
(AD-A099395; TR-556; ESD-TR-81-39) Avail: NTIS HC A03/MF A01 CSCL 17/2

Two experimental vocoder systems are described which exploit the frame-fill concept described by McLarnon to achieve data rates in the range of 800 to 1200 bps. One is based on a well-known 2400 bps channel vocoder design, the second is based on a form of the Lincoln 2400 bps linear predictive coder (LPC-10) algorithm. Both systems were found to perform well at the 1200 bps rate representing a 2:1 savings in transmission bandwidth at very little additional algorithm complexity. At 800 bps both systems were judged usable but not wholly satisfactory. Performance of the channel vocoder was considered marginally better than LPC at 800 bps. Author (GRA)

N81-26352# Boeing Aerospace Co., Huntsville, Ala. Systems Simulation and Development Directorate.
VERIFICATION AND VALIDATION OF RF ENVIRONMENTAL MODELS: METHODOLOGY OVERVIEW
A. M. Baird, R. B. Goldman, N. C. Randal, W. C. Bryan, F. M. Belrose, and W. C. Holt 15 Oct. 1980 51 p refs
(Contract DAAK40-77-C-0176)
(AD-A099324; AD-E950117; DRSMI-81-2-TR) Avail: NTIS HC A04/MF A01 CSCL 17/7

This technical report describes the general methodology behind the validation and verification of the RF environmental models as applied to HWIL Simulation. The different phases of verification including implementation of RF models and propagated RF signals are presented. Validation of environmental models is discussed with emphasis on quantitative methods. Author (GRA)

N81-26353# Science Applications, Inc., Tucson, Ariz.
ABLE SYSTEM DESCRIPTION Final Report
Carroll F. Lam and John R. Scott 6 Feb. 1981 82 p
(Contract F33657-79-C-0178)
(AD-A098987; SAI-TR-04-165-5) Avail: NTIS HC A05/MF A01 CSCL 17/2

This document provides an overview of the ABLE system, its mission, key components and an intended operational philosophy. The intent of this description is to enable the reader to gain a top level understanding of what ABLE is and how it may be used. The Advanced Building block for Large Area Exploitation (ABLE-1) is the integration of modern state-of-the-art digital radar exploitation concepts into a single system. ABLE demonstrates the increased throughput and responsiveness which digital technology allows and provides a number of previously unrealized operational advantages. These include the ability to support near-continuous surveillance of the battlefield, to respond to tasking changes in the near real-time, to utilize multiple intelligence sources to direct exploitation, and to rapidly exploit and report targets. Author (GRA)

N81-26354# Harry Diamond Labs., Adelphi, Md.
MEASUREMENT OF SCALED-DOWN HIGH-ALTITUDE ELECTROMAGNETIC PULSE (HEMP) WAVEFORMS
Andrew A. Cuneo, Jr. and James J. Loftus Army Electronics Research and Development Command Mar. 1981 29 p
(DA Proj. 1X4-64307-D-212)
(AD-A099032; HDL-TM-81-6) Avail: NTIS HC A03/MF A01 CSCL 20/14

If one desires to scale down a high-altitude electromagnetic pulse waveform to illuminate and measure the response of a physically scaled version of an Army tactical system, he is confronted with the problems of how to measure the radiated pulse, what the limitations of existing field sensors are, and what new sensors are required. This report discusses the techniques used by the Harry Diamond Laboratories to adequately describe the early time of the radiated fields in the scale modeling facility. Author (GRA)

N81-26355# National Telecommunications and Information Administration, Annapolis, Md.
SPECTRUM RESOURCE ASSESSMENT IN THE 1710-1850 MHz BAND
Gerald F. Hurt and Gordon A. Crandall, III Sep. 1980 121 p refs
(PB81-158701; NTIA/REPT-80-47) Avail: NTIS HC A06/MF A01 CSCL 17B

The spectrum resource assessment of the 1710-1850 MHz band is described. Information on frequency allocations, technical standards, spectrum usage and identification of key spectrum management issues is presented. The key problem areas identified are the sharing between fixed and aeronautical mobile services, coordination of Earth stations, accommodation of the packet radio systems, and congestion of certain geographic areas in the continental U.S. Key issues are examined and improvements to the current spectrum management process to assure the efficient use of the limited available spectrum are identified. GRA

N81-26356# Institute for Telecommunication Sciences, Boulder, Colo.
AN ANALYSIS OF THE COMPATIBILITY OF SPREAD-SPECTRUM AND NARROWBAND FM MOBILE RADIO SYSTEMS IN THE 156- TO 162-MHZ BAND
T. deHaas and C. C. Watterson Nov. 1980 54 p refs
(PB81-157711; MA-RD-940-81011) Avail: NTIS HC A04/MF A01 CSCL 17B

The present limited availability of channels for VHF-UHF land-mobile voice radio communication in urban areas might be alleviated by using spread-spectrum (SS) systems in the same frequency bands and geographic areas presently used by frequency-multiplexed, narrowband, frequency-modulated (FM) systems. An analysis of the compatibility of FM and direct-sequence SS systems under these conditions is presented and the results applied to a specific case: SS communication with ships in the Mississippi River in the New Orleans area. The analysis shows that SS and FM systems in the same frequency band and geographic area cause intolerable mutual interference that makes them incompatible. Some alternative possibilities which may be worth further investigation are given. GRA

N81-26357# Institute for Telecommunication Sciences, Boulder, Colo.
FREQUENCY ASSIGNMENT METHODOLOGY: AN ANNOTATED BIBLIOGRAPHY
William K. Hale Nov. 1980 47 p
(PB81-153421; NTIA/SP-80-10) Avail: NTIS HC A03/MF A01 CSCL 17B

Frequency assignment techniques which consume less spectrum than the state of the art operational systems are discussed. The techniques are efficient tools for determining the amount of spectrum to allocate for a proposed new service and were applied to economicaly quantify relationships between spectrum efficiency, equipment characteristics and operational procedures. An annotated bibliography was compiled to assemble information about developments related to frequency assignment methodology. The bibliography is organized into: overview and general references, engineering applications, exact algorithms, approximate algorithms, complexity of frequency assignment problems, upper bounds, and lower bounds. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N81-26358* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ADAPTIVE POLARIZATION SEPARATION Patent
Guy M. Pelchat (Harris Corp., Melbourne, Fla.), George G. Rassweiler (Harris Corp., Melbourne, Fla.), Anthony Gianatasio (Harris Corp., Melbourne, Fla.), and Lock R. Young, inventors (to NASA) (Harris Corp., Melbourne, Fla.) Issued 28 Apr. 1981 6 p Filed 6 Mar. 1979 Supersedes N79-18154 (17 - 09, p 1118) Sponsored by NASA
(NASA-Case-LAR-12196-1; US-Patent-4,264,908; US-Patent-Appl-SN-017887; US-Patent-Class-343-100PE)
Avail: US Patent and Trademark Office CSCL 09C

A broadband adaptively controlled polarization separation network is discussed. Two transmitted signals vertically and horizontally polarized are received as elliptically polarized signals. If there is any vertical polarization on the other signal the separation network provides two signals. The separation is done automatically by the use of two sets of crosscouplers which couple a single line to the other line to complete the polarization decoupling operation.

Official Gazette of the U.S. Patent and Trademark Office

N81-26359* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
DECOMMUTATOR PATCHBOARD VERIFIER Patent
John W. Brunson, inventor (to NASA) Issued 12 May 1981 7 p Filed 22 Jun. 1979 Supersedes N79-27865 (17 - 18, p 2462)
(NASA-Case-KSC-11065-1; US-Patent-4,267,594; US-Patent-Appl-SN-051271; US-Patent-Class-371-20; US-Patent-Class-371-25; US-Patent-Class-324-51; US-Patent-Class-324-73AT) Avail: US Patent and Trademark Office CSCL 09C

A system for automatically verifying the connections between terminals of a patchboard is described. The system includes a back plane having a plurality of plugs corresponding to the pins of the patchboard. A number of decoders are connected to the plugs of the back plane so that a signal can be sequentially applied to each plug of the back plane under control of a stepping register and a control circuit. A plurality of data selectors are also connected to the plugs of the back plane and under control of a second external register. This control circuit sequentially makes connections between an output circuit and the plugs of the back plane so as to patch the signal applied to a respective plug through a patch connection to the output circuit. The precise locations of the patches on the patchboard can be identified and compared with previously stored information in a memory unit. Official Gazette of the U.S. Patent and Trademark Office

N81-26360* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF MAKING V-MOS FIELD EFFECT TRANSISTORS UTILIZING A TWO-STEP ANISOTROPIC ETCHING AND ION IMPLANTATION Patent
Murzban D. Jhabvala, inventor (to NASA) Issued 9 Jun. 1981 6 p Filed 5 Sep. 1979 Supersedes N80-12281 (18 - 03, p 0318)
(NASA-Case-GSC-12515-1; US-Patent-4,272,302; US-Patent-Appl-SN-172727; US-Patent-Class-148-1.5; US-Patent-Class-29-571; US-Patent-Class-29-578; US-Patent-Class-29-580; US-Patent-Class-148-187; US-Patent-Class-156-647; US-Patent-Class-156-648; US-Patent-Class-156-649; US-Patent-Class-357-23; US-Patent-Class-357-55; US-Patent-Class-357-60; US-Patent-Class-357-91) Avail: US Patent and Trademark Office CSCL 09A

A method of making V-MOS field effect transistors is disclosed wherein a masking layer is first formed over a surface of a crystalline substrate. An aperture is then formed in the masking layer to expose the surface of the substrate. An anisotropic etchant is applied to the exposed surface so that a groove having a decreasing width within increasing depth is formed. However, the etch is not allowed to go to completion with the result that a partially formed V-shaped groove is formed. Ions are accelerated through the aperture for implantation in the crystalline substrate in the lower portion of the partially formed V-shaped groove. Thereafter, an anisotropic etchant is reapplied to the partially formed V-shaped groove, and the etch is allowed to go to completion.

Official Gazette of the U.S. Patent and Trademark Office

N81-26361 Pittsburg Univ., Pa.
A GEOMETRIC POLYAUTOMATION MODEL AND ITS APPLICATION TO THREE-DIMENSIONAL RECONSTRUCTION FROM SERIAL CROSS-SECTIONS Ph.D. Thesis
John Slinger TodHunter 1980 94 p
Avail: Univ. Microfilms Order No. 8112710

A polyautomaton model in which each machine in the polyautomaton carries a description of a connected set of image elements is described. Operations on the geometric domains of the polyautomata lead to irregular and dynamic interconnection structure. Various realizations of the model, characterized by the description of the domains covered by each machine, may be simulated by each other, and specifically by cellular arrays. The model provides a powerful tool for image segmentation and three dimensional object isolation from serial images. The model is applied to a sequence of histological preparations of fetal head material in order to identify homogeneous structures present in the specimen. Methods for removal of hidden and undersired objects from display processing are performed through use of the data structures of the model. Dissert. Abstr.

N81-26362 Connecticut Univ., Storrs.
SEQUENTIAL DETECTION OF SOFT FAILURES IN LINEAR SYSTEMS Ph.D. Thesis
Bhal Ramchandra Tulpule 1981 172 p
Avail: Univ. Microfilms Order No. 8111915

On-line and off-line schemes for sequentially detecting significant system changes which can be represented by deviations in the statistical parameters of errors is considered. The model

used does not specifically include the nature and time onset time of failure. The on-line scheme utilizes a Kalman filter corresponding to the design values of statistical system parameters and is based on a recursive relation for the nonwhite filter innovations. The scheme has modest computational requirements and involves monitoring the sampler number trajectory for sudden and nontransient changes. Following detection of a soft failure, the estimation schemes can be used to identify the failed parameters. The off-line scheme is a maximum likelihood estimate. Two examples are presented to illustrate the implementation of the algorithms and demonstrate the detection and robust estimation capabilities of the schemes. The problem of maneuvering targets is reformulated in the soft failure framework via sudden changes in the appropriate variables. The failure isolation capabilities of a bank of detectors scheme are demonstrated via the maneuvering target problem. Dissert. Abstr.

N81-26363 Cornell Univ., Ithaca, N. Y.
THE EFFECTS OF DELAYED SECONDARY AVALANCHE PHENOMENA ON THE HIGH EFFICIENCY OPERATION OF GaAs MILLIMETER WAVE IMPATT DIODES Ph.D. Thesis
Glenn Richard Thoren 1981 286 p
Avail: Univ. Microfilms Order No. 8110950

The effects of the Delayed Secondary Avalanched (DSA) carriers on the operation of the IMPATT were simulated in a computer model of the large signal operation of the diode over a range of millimeter wave frequencies. Time evolution of DSA effects in a single drift GaAs IMPATT are shown. Data were obtained by testing both single drift and double drift GaAs IMPATTs. An abrupt increase in the power and efficiency of the experimental IMPATTs at large signal levels correlated well with the computer simulation of DSA mode operation. It is shown that other sources of saturation like current from Schottky barrier thermionic emission, tunneling, diffusion, and generation in the depletion region are insufficient to stimulate the generation of the high density, majority carrier packets needed to achieve high power and high efficiency in GaAs IMPATTs at millimeter wave frequencies. The velocity of holes and electrons at elevated temperatures and high electric fields is lower than previously assumed and critical to the proper modelling of the IMPATTs. The state-of-the-art for IMPATT diodes above 10 GHz is reviewed. The 'surfing mode' theories for high efficiency operation below 30 GHz are presented. It is concluded that DSA effects has a substantial influence on the operation of millimeter wave GaAs IMPATTs. Dissert. Abstr.

N81-26364 Pittsburg Univ., Pa.
TRANSIENT SIMULATION OF SUPERCONDUCTING SYNCHRONOUS MACHINES Ph.D. Thesis
Athanasios G. Koronides 1980 171 p
Avail: Univ. Microfilms Order No. 8112701

A computer model is developed to study the electromechanical interactions between superconducting generators and power systems during various fault conditions. A large set of equivalent circuits is used to represent the eddy currents on the finite length electromagnetic cylindrical shields which surround the superconducting field winding. The armature and field windings are represented by coupled circuits as in conventional generator models. The rotor turbine shaft dynamics are introduced in the model by a set of lumped masses representing the various stages of the turbine and the rotor, connected by springs representing the shaft. The electrical and mechanical equations of the machine are related by the air gap torque equation in a large system of simultaneous, nonlinear differential equations. The developed computer algorithms used to study the transient behavior of a 300 MCA superconducting generator and the results are reported. Dissert. Abstr.

N81-26365 Massachusetts Univ., Amherst.
A THEORY OF 1/F NOISE IN THIN METAL FILMS Ph.D. Thesis
Igor Stanislav Pavlin 1981 119 p
Avail: Univ. Microfilms Order No. 8110361

A theory of correlated equilibrium temperature fluctuations based on measurements of voltage spectra observed in thin metal films is presented. The observed If (low frequency) dependence in the spectra implies long-time correlated behavior in fluctuations of resistivity. The magnitude and the shape of the spectra are explained. A Gibbs free energy model is presented, utilizing the concept of a temperature dependent correlation length. Poor thermal contact between films and substrates is assumed. To investigate random boundary conditions, a method using Green's functions is developed. It is shown that If spectral dependence can be obtained as a result of proper random boundary conditions. The spectrum of temperature fluctuations for a system not far from equilibrium is found. It is proven that the assumption of nonequilibrium is not a necessary condition for correlated temperature fluctuations. Additional evidence of the universality of If noise is proposed in the velocity fluctuations of superflows. Dissert. Abstr.

N81-26366 Marquette Univ., Milwaukee, Wis.
ELECTRICAL CHARACTERIZATION OF GRAIN BOUNDARIES IN ZnO-BASED VARISTORS Ph.D. Thesis
William Clive Richmond 1980 277 p
Avail: Univ. Microfilms Order No. 8111865

The material of the ZnO-based varistor (MOV) was examined. The microstructure of the fired mixture consists of ZnO grains, formed during liquid phase sintering, which are surrounded by a discontinuous intergranular phase. The following varistor electrical properties were observed: (1) low voltage dc current-voltage characteristic: (2) high current pulsed current-voltage characteristic: (3) small signal admittance in the frequency range 0.1 Hz to 100 MHz; (4) admittance bias voltage response at 1MHz; and (5) the instability to bias of the leakage currents. The results are described by a model of back to back depletion layers existing at the ZnO/ZnO grain interface. It was determined, that the depletion layer donor density is derived from the oxide additives to ZnO. Dissert. Abstr.

N81-26367 California Univ., Davis.
ELECTRON ENERGY TRANSPORT AND ANOMALOUS dc RESISTIVITY Ph.D. Thesis
Charles Lim Yee 1980 118 p
Avail: Univ. Microfilms Order No. 8112037

The effect of hot electron trapping in a self-consistent electric field was investigated. Regimes of parameter space in the suprathermal/thermal electron density and temperature necessary to produce a large self consistent dc field were identified. Calculations show that a large dc potential exists for parameters typical of microwave plasma absorption experiments. This dc potential traps a portion of the suprathermal (hot) electrons, reducing the hot energy transport. The thermal electrons are strongly scattered by the ion acoustic turbulence with the thermal heat flux reversed near the critical surface. Inward energy flux due to electron thermal conduction is comparable to the outward thermal energy flux due to thermal convection. The thermal electrons can be strongly joule heated by scattering off the ion acoustic turbulence. Dissert. Abstr.

N81-26368 Pittsburg Univ., Pa.
THE TIME-DEPENDENT FINITE-ELEMENT MODELING OF THE ELECTROMAGNETIC FIELD IN ELECTRICAL MACHINES: METHODS AND APPLICATIONS Ph.D. Thesis
Elias Georgiou Strangas 1980 146 p
Avail: Univ. Microfilms Order No. 8112709

A method to calculate the field quantities at a cross section of an electrical rotating machine, and to use these quantities to calculate the machine parameters and performance was investigated. The method includes the effects of eddy currents and saturation and calculates the inductances, torque and losses due to eddy currents. The method is applicable to cases which cannot be described by a constant set of parameters, but rather where these parameters become functions of time and field solution. The underrelaxation method is applied to the calculations of the saturation levels in iron parts. The solution of the magnetic potential at the cross section of the machine is used to calculate inductances through flux linkages, and torque through the application of the Maxwell stress tensor at a surface in the airgap. Dissert. Abstr.

N81-26369 Duke Univ., Durham, N. C.
INTERACTIONS OF LOSSY SAMPLES IN A COAXIAL TRANSMISSION LINE WITH AN ELECTROMAGNETIC FIELD Ph.D. Thesis
Daniel Joseph Schaefer 1980 137 p

Avail: Univ. Microfilms Order No. 8112318

Techniques were developed to obtain the real and the imaginary parts of the complex permittivity and the absorption at 400 discrete frequencies per experiment for a sample in a coaxial transmission line. An approximate closed form solution was developed which is used to seed a numerical algorithm that rapidly converges to the complex permittivity. These permittivity values are used to predict the experimentally measured power levels until the predicted and measured values agree within a preset tolerance. A modified Newton-Raphson algorithm with approximations for the derivatives is used. A distributed disc or staggered sectoral sample holder is developed and analyzed for any arbitrary number of sectors. The distributed disc completely eliminates higher order mode errors in lossless materials. It is emphasized that the analysis of the disc sample, the use of approximations for the hyperbolic functions used in calculating the derivatives to make the Newton-Raphson algorithm less cumbersome, and the concept and analysis of the distributed disc sample are all new. Dissert. Abstr.

N81-26370 Marquette Univ., Milwaukee, Wis.
THE EXPANDED STATE MODEL AND FINITE WORD LENGTH EFFECTS IN 2-D DIGITAL FILTERS Ph.D. Thesis
Prakash M. Ambegaonkar 1980 206 p refs
Avail: Univ. Microfilms Order No. 8111848

The quantization error analysis of two dimensional digital filters on the two dimensional expanded state model was examined. Three error systems are introduced for the three sources of quantization error: input quantization, multiplier quantization, and summer quantization. It is argued that the expanded state model offers a general approach to perform the limit cycle analysis of digital filters. The same error system used in the quantization noise analysis is also used in the limit cycle analysis. The expanded state model expresses the filter in terms of the expanded state matrices and the period of the limit cycle and is used to establish bounds on the amplitude of the limit cycles. Asymptotic behavior of the digial filters was also studied. The overflow problem of one dimensional and two dimensional digital filters is analyzed. Using this impulse response, the filter can be scaled to avoid summer overflow. In addition the expanded state model is used to provide composite state variable and summer variable scaling. Dissert. Abstr.

N81-26371 Michigan State Univ., East Lansing.
THE TEMPERATURE DEPENDENCE OF THE RESISTIVITY OF THE NOBLE METALS FROM 0.03 TO 9 K Ph.D. Thesis
Steven Dale Steenwyk 1980 167 p
Avail: Univ. Microfilms Order No. 8112158

The temperature dependent resistivity of the noble metals for temperatures from 0.3 K to 9 K was investigated. The magnitude of the electron-electron scattering contributions and the magnitude and mathematical form of the phonon contribution and its variation with strain and impurity content was determined. The dominant contributors to the residual resistivity, impurity and dislocation scattering in the anistropy in k-space of the relaxation time mechanisms were considered. Problems in using a SQUID based measuring system on samples of nano-ohm resistance, and the use of superconducting chokes and transformers to control the electrical response time of the circuit are treated. The theory of Bermann, Kaveh and Wiser is verified. It was found that the effect of dislocation is a reduction in the phonon scattering and dislocations increase the electron-electron contribution. Dissert. Abstr.

N81-26372*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CAPACITOR TECHNOLOGIES, APPLICATIONS AND RELIABILITY
Jun. 1981 158 p refs Proceedings of a Symp. held at Marshall Space Flight Center, Ala., 24-25 Feb. 1981
(NASA-CP-2186; M-351) Avail: NTIS HC A08/MF A01 CSCL 09A

Various aspects of capacitor technologies and applications are discussed. Major emphasis is placed on: the causes of failures; accelerated testing; screening tests; destructive physical analysis; applications techniques; and improvements in capacitor capabilities. For individual titles, see N81-26373 through N81-26392.

N81-26373*# Sandia Labs., Albuquerque, N. Mex.
RADIATION RESPONSE AND ELECTRICAL PROPERTIES OF POLYMER ENERGY STORAGE CAPACITORS: PVF2, POLYSULFONE, AND MYLAR
L. Rogers Edwards *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 1-5 refs Sponsored in part by DOE (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

Efforts were made to develop a polymer film capacitor that is tolerant to radiation. The capacitors are to be utilized in a high voltage pulse discharge application. Radiation response data at high dose/dose rate levels are presented for polyvinylidene fluoride (PVF2), polysulfone, and Mylar. The results show that PVF2 is the most radiation tolerant while Mylar is the least tolerant. The data also show that the radiation response is quite dependent on operating electric stress. R.C.T.

N81-26374*# Union Carbide Corp., Greenville, S.C. Components Dept.
POLYVINYLIDENE FLUORIDE FILM AS A CAPACITOR DIELECTRIC
Henrique V. DeMatos *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 7-12 refs (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

Thin strips of polyvinylidene fluoride film (PVDF) with vacuum deposited electrodes were made into capacitors by conventional winding and fabrication techniques. These devices were used to identify and evaluate the performance characteristics offered by the PVDF in metallized film capacitors. Variations in capacitor parameters with temperature and frequence were evaluated and compared with other dielectric films. Their impact on capacitor applications is discussed. R.C.T.

N81-26375*# Sandia Labs., Albuquerque, N. Mex.
THE APPLICATION OF PERFLUOROCARBONS AS IMPREGNANTS FOR PLASTIC FILM CAPACITORS
G. Howard Mauldin *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 13-17 refs Sponsored in part by DOE (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

A liquid impregnated, plastic film (wet) capacitor was developed that is thought to be the most reliable and space efficient capacitor of any type ever produced for high voltage, pulse discharge service. The initial design stores five times the energy of a premium quality dry capacitor of equivalent energy and reliability. The technology, as well as a production capacitor design using this technology are described. R.C.T.

N81-26376*# Union Carbide Corp., Greenville, S.C.
PERFORMANCE COMPARISON: ALUMINUM ELECTROLYTIC AND SOLID TANTALUM CAPACITOR
B. G. Hawthornthwaite, J. Piper, and H. W. Holland *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 19-25 (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

Several key electrical and environmental parameters of latest technology aluminum electrolytic and solid tantalum capacitors were evaluated in terms of price fluctuations of tantalum metal. Performance differences between solid tantalums and aluminum electrolytics are examined. R.C.T.

N81-26377*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Electronics and Control Lab.
UNSTABLE INSULATION RESISTANCE IN CERAMIC CAPACITORS
A. M. Holladay *In its* Capacitor Technol., Appl. and Reliability Jun. 1981 p 27-31 refs (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

The effects of low and varying values of insulation resistance (IR) and their significance in the cause of failure in ceramic capacitors were investigated. Two specific instances involving hardware failure involving ceramic capacitors were examined. It

is shown that monolithic, multilayer ceramic capacitors may exhibit low and unstable IR at low voltages, or exhibit no voltage. Other significant results are reported. R.C.T.

N81-26378*# Sprague Electric Co., Clinton, Tenn.
INFLUENCE OF CURRENT NEEDS ON THE ADVANCEMENT OF ALUMINUM ELECTROLYTIC CAPACITORS
Joseph A. Moresi *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 33-37 (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

The need for cost effective, high performance, long life capacitors with improved reliability is discussed. It is shown that a low cost, miniature aluminum capacitor, with improved reliability and proven life, can be produced with existing technology. It is further shown that the capacitor can be specified for 125 C life and shelf test requirements, and meet established standards for their parametric performance. R.C.T.

N81-26379*# Electronic Concepts, Eatontown, N.J.
SUPER MINIATURIZATION OF FILM CAPACITOR DIELECTRICS
Bernard Lavene *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 39-43 (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

The alignment of the stable electrical characteristics of film capacitors in the physical dimensions of ceramic and tantalum capacitors are discussed. The reliability of polycarbonate and mylar capacitors are described with respect to their compatibility with military specifications. Graphic illustrations are presented which show electrical and physical comparisons of film, ceramic, and tantalum capacitors. The major focus is on volumetric efficiency, weight reduction, and electrical stability. R.C.T.

N81-26380*# Sprague Electric Co., North Adams, Mass.
EFFECTS OF SEVERE STRESSING ON TANTALUM CAPACITORS
Jill F. Shakar and Edward H. Fairfield *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 45-52 (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

The ultimate capabilities of an all tantalum capacitor were determined and evaluated. The evaluation included: 175 C life; 100 cycle thermal shock; 70 g random vibration; 3000 g shock; and 90 C ase ripple current. R.C.T.

N81-26381*# Clarkson Coll. of Technology, Potsdam, N.Y.
BREAKDOWN VOLTAGE OF DISCRETE CAPACITORS UNDER SINGLE-PULSE CONDITIONS
Henry Domingos, Joe Scaturro, and Larry Hayes *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 53-62 refs (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

For electrostatic capacitors the breakdown voltage is inherently related to the properties of the dielectric, with the important parameters being the dielectric field strength which is related to the dielectric constant and the dielectric thickness. These are not necessarily related to the capacitance value and the rated voltage, but generally the larger values of capacitance have lower breakdown voltages. Foil and wet slug electrolytics can withstand conduction currents pulses without apparent damage (in either direction for foil types). For solid tantalums, damage occurs whenever the capacitor charges to the forming voltage. E.D.K.

N81-26382*# Union Carbide Corp., Greenville, S.C.
INTERNAL FUSE MODULES FOR SOLID TANTALUM CAPACITORS
Henrique V. DeMatos *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 63-68 refs (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

Miniature fuse modules were designed for and incorporated into two styles of solid tantalum capacitors. One is an epoxy molded, radial leaded, high frequency decoupling capacitor; the other is an hermetically sealed device with axial lead wires. The fusible element for both devices consists of a fine bimetallic wire which reacts exothermically upon reaching a critical temperature and then disintegrates. The desirability of having fused devices is discussed and design constraints, in particular those which minimize inductance and series resistance while optimizing fuse actuation characteristics, are reviewed. Factors affecting the amount of energy required to actuate the fuse and reliability of acuation are identified. E.D.K.

N81-26383*# Ceag Electric Corp., Hauppauge, N.Y.
SPECIFYING CAPACITORS FOR PERFORMANCE AND RELIABILITY IN SWITCHING POWER SUPPLIES
Franklin E. Greenhalgh *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 69-73 refs (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

The three most commonly used switching circuits are the full bridge converter, the half bridge converter, and the forward converter. All three circuits use the same pulse width concept for regulation with the major difference being how many transistors are used for power handling. The full bridge uses four transistors, the half bridge uses two, and the forward converter uses one. In practical design, forward converters are used at 300 watts and below, half bridges at 300 to 600 watts, and full bridges above 600 watts. Regulation is achieved by alternately saturating diagonal pairs of transistors in the full bridge, alternately saturating transistors in the half bridge, and simply pulse modulating one transistor in the forward converter. E.D.K.

N81-26384*# TRW Defense and Space Systems Group, Redondo Beach, Calif. Components Engineering Dept.
MONOLITHIC CERAMIC CAPACITORS FOR HIGH RELIABILITY APPLICATIONS
E. B. Thornley *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 75-88 (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

Monolithic multi-layer ceramic dielectric capacitors are widely used in high reliability applications in spacecraft, launch vehicles, and military equipment. Their relatively low cost, wide range of values, and package styles are attractive features that result in high usage in electronic circuitry in these applications. Design and construction of monolithic ceramic dielectric capacitors, defects that can lead to failure, and methods for defect detection that are being incorporated in military specifications are discussed. E.D.K.

N81-26385*# Northrop Corporate Labs., Hawthorne, Calif. Electronics Div.
CAPACITORS, THERMAL RATING/DERATING (ac-dc OPERATION)
J. W. Borough *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 89-97 refs (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

Application techniques for determining performance and ratings of cased capacitors under combined operation as a function of the actual operating conditions are described. Thermal impedances between the case and external environment and between the internal hot spot and case are taken into account. E.D.K.

N81-26386*# Bell Telephone Labs., Inc., Allentown, Pa.
ACCELERATED LIFE TESTING AND RELIABILITY OF HIGH K MULTILAYER CERAMIC CAPACITORS
W. J. Minford *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 93-97 refs (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

The reliability of one lot of high K multilayer ceramic capacitors was evaluated using accelerated life testing. The degradation in insulation resistance was characterized as a function of voltage and temperature. The times to failure at a voltage-temperature stress conformed to a lognormal distribution with a standard deviation approximately 0.5. E.D.K.

N81-26387*# Hughes Aircraft Co., Culver City, Calif.
A CAUSE OF THE NON-SOLDERABILITY OF CERAMIC CAPACITOR TERMINATIONS
M. J. Cozzolino, A. Kumar (SEAL, Inc., Culver City, Calif.), and G. J. Ewell *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 99-104 (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

The results of an analysis into the cause of the non-solderability of multiple defective part lots from two capacitor manufacturers are described. This analysis consisted of visual, scanning electron microscopic, surface, and metalographic examinations and analyses. The results indicated that non-solderability results from areas of excess porosity in the termination which are caused by segregation of ink constituents during manufacturing. This segregation can be minimized by proper monitoring and control of process variables; where excess porosity does occur, solderability can be improved by proper precleaning of parts. E.D.K.

N81-26388*# AVX-Ceramics Corp., Myrtle Beach, S.C.
ULTRASONIC SCANNING OF MULTILAYER CERAMIC CHIP CAPACITORS
F. N. Bradley *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 105-110 refs (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

Ultrasonic scanning is compared to neutron radiography and scanning laser acoustic microscopy (SLAM). Data show that SLAM and ultrasonic scanning evaluations are in good agreement. There is poor agreement between N-ray and both ultrasonic techniques because N-ray is insensitive to all but the grossest delaminations. Statistical analysis show a good correlation between ultrasonic scanning and destructive physical analysis. E.D.K.

N81-26389*# Sperry Rand Corp., Greenbelt, Md. System Management Div.
A COMPARISON OF SCREENING TECHNIQUES FOR CERAMIC CAPACITORS Interim Report
Gerard F. Kiernan *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 111-117 refs Sponsored by NASA. Goddard Space Flight Center (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

The techniques involved are ultrasonic scanning, neutron radiography, scanning laser acoustic microscopy, and voltage conditioning. The test capacitor, for this first phase, is a 0.47 uF, 50V capacitor style CKR06. Eighteen of 768 devices failed in voltage conditioning with elapsed times from 15 minutes to 1239 hours. Eleven of the failures were detected by ultrasonic scanning. Four failures were found by neutron radiography. Fourteen failures showed up in the acoustic microscopy test. Three failures in voltage conditioning were not detected by any of the techniques. Failures were confirmed by destructive physical analysis. There is no direct relationship between the size of the defect and electrical failure. E.D.K.

N81-26390*# Sprague Electric Co., North Adams, Mass.
HIGH-FREQUENCY MEASUREMENTS OF MULTILAYER CERAMIC CAPACITORS
Raymond E. Lafferty (Boonton Electronics, Parsippany, N.J.) and John P. Maher *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 119-122 (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

A resonant coaxial transmission line, short circuited at one end and open circuited at the other, whose fundamental resonant frequency and Q factor are known, is perturbed with a test capacitor connected either in series at the shorted end of the line, or in shunt at the open end. Measuring the Q factor of the system with the delta f technique yields the effective series resistance, capacitance, and the Q factor of the test specimen. This method of measurement has the advantage that there are no adjustable elements to alter circuit conditions in an unprescribed way, the only variable is the frequency which can be measured with an uncertainty of less than 1 ppm, the loss of the line as a function of frequency is quite predictable, and the Q factor of the line can be made sufficiently high to support accurate measurements of low loss capacitors. E.D.K.

N81-26391*# Boeing Aerospace Co., Seattle, Wash.
CAPACITOR DPA: DOES IT DO ANY GOOD?
David C. Porter *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 125-129 (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

Methods of destructive physical analysis (DPA) are suggested which might have more usefulness if the procedures followed lines of accelerated testing. A brief presentation of DPA procedures is followed by a discussion of their value. E.D.K.

N81-26392*# Martin Marietta Corp., Denver, Colo.
FAILURE ANALYSIS METHODS FOR CAPACITORS
R. L. Hildenbrand *In* NASA. Marshall Space Flight Center Capacitor Technol., Appl. and Reliability Jun. 1981 p 131-148 refs (For primary document see N81-26372 17-33)
Avail: NTIS HC A08/MF A01 CSCL 09A

The basic steps in the failure analysis of discrete capacitors used in electronic circuit boards and hybrid assemblies are described. These steps include: visual examination; functional test; disassembly; isolation of the failure site; and documentation. E.D.K.

N81-26393# Texas Instruments, Inc., Dallas. Central Research Labs.
MONOLITHIC INTEGRATION OF MICROWAVE GaAs POWER FETS Annual Technical Report, 10 Oct. 1979 - 30 Nov. 1980
V. Sokolov and R. E. Williams Jan. 1981 29 p
(Contract N00014-77-C-0657; NR Proj. 251-026)
(AD-A099156; TI-08-80-03) Avail: NTIS HC A03/MF A01 CSCL 09/5

Efforts during the third year of this contract have included further performance improvements of the two-stage monolithic push-pull amplifier, successful demonstration of the paraphase amplifier at lower X-band frequencies, testing of the fully integrated push-pull (FIPP) discrete devices and design and development of a mask set for an X-band dual-gate push-pull power FET device structure. Performance results for the two-stage push-pull amplifier include a saturated CW output power of 1.4 W, a small signal gain of 16 dB with a 1 dB gain compression point of 1.3 W at 9.0 GHz. The paraphase amplifier has demonstrated active balun action from 6.5 to 9.0 GHz. The gain is -3 dB for each antiphase output at 8.0 GHz and tracks within + or - 0.75 dB over the 6.5 to 9.0 GHz frequency range. Phase tracking of the 180 deg characteristic is within + or - 20 deg. Preliminary results for the 1.2 mm gate width FIPP devices indicate higher small signal gains than for conventional FETs with comparable gate width. Narrow-band small signal gains up to 12 dB have been obtained at 10 GHz.
Author (GRA)

N81-26394# Ohio Univ., Athens. Dept. of Electrical Engineering.
VLF P-STATIC NOISE REDUCTION IN AIRCRAFT. VOLUME 2: RECOMMENDED ACTION Final Report, May 1979 - Aug. 1980
Robert W. Lilley Oct. 1980 12 p refs 2 Vol.
(Contract DOT-FA79WA-4320)
(AD-A099130; EER-48-2; FAA-RD-80-137-2) Avail: NTIS HC A02/MF A01 CSCL 09/4

Recommendations for experimentation and action to reduce p-static effects on low-frequency navigation are presented, with emphasis on awareness of p-static symptoms and cures by the aviation community. Experimentation to verify effects of new mechanical and electrical technology on p-static reduction is proposed. The potential for interference by related noise sources such as lightning discharges is noted. Author (GRA)

N81-26395# Raytheon Co., Waltham, Mass.
FET NOISE STUDIES Final Report, Nov. 1978 - Feb. 1981
R. A. Pucel Mar. 1981 148 p refs
(Contract F49620-79-C-0024; AF Proj. 2306)
(AD-A098795; S-2899; AFOSR-81-0438TR) Avail: NTIS HC A07/MF A01 CSCL 09/1

The GaAs FET oscillator is an alternative device for voltage-controlled oscillator (VCO) applications because of its inherent wide-band electronic tunability, the variety of operating modes possible such as common source, common gate, etc., and the ease of circuit design. However, it has one major drawback, namely, its high near-carrier 1/f noise which makes it unsuitable for many applications, such as radar systems. This report describes the progress made during the report period in understanding the physical mechanisms responsible for this noise. During this period, an extensive experimental study was made of the 1/f noise properties of a variety of oscillators constructed of FET chips fabricated under controlled conditions. Using in-house grown epitaxial wafers, FET's were fabricated from both buffered and unbuffered active layers, with and without epitaxially grown contact layers, and with and without surface passivation. The experimental results show a good correlation between the trap-generated 1/f baseband noise and the near-carrier 1/f FM noise. The primary sources of the noise are presumed to be either deep traps within the depletion layer under the gate or surface states at the gate-semiconductor interface, probably the latter. An improvement of the order of 10 dB in the near carrier FM noise level is obtained when a buffer layer separates the active layer from the substrate. Optical experiments indicated an electron trap level approximately 0.41 eV below the conduction band. A noise model was devised to explain the modulation process for upconverting baseband 1/f noise to the carrier band by depletion layer modulation. GRA

N81-26396# Rome Air Development Center, Hanscom AFB, Mass.

BURN-IN: WHICH ENVIRONMENTAL STRESS SCREENS SHOULD BE USED?

Douglas Karam Griffiss AFB, N.Y. Mar. 1981 63 p refs (AF Proj. 2338)
(AD-A099207; RADC-TR-81-87) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report is based on a literature survey of stress screening studies and concludes that thermal cycling and random vibration are the two most powerful screens. Reports dealing with thermal cycling and random vibration tests are discussed and some conclusions and areas that need further research are drawn from them. Recommendations are also given for a military standard on burn-in based on the findings in this report. Author (GRA)

N81-26397# Northrop Corp., Rolling Meadows, Ill. Defense Systems Div.

I/J BAND LOW-COST CROSSED-FIELD AMPLIFIER Final Technical Report, 30 Sep. 1978 - 30 Sep. 1980

Robert R. Moats 31 Mar. 1981 53 p refs
(Contract DAAB07-78-C-2981; DA Proj. 1L1-62705-AH-94) (AD-A098978; DSD-094-009714; DELET-TR-78-2981-F) Avail: NTIS HC A04/MF A01 CSCL 09/5

This program is directed toward development of an I/J band, linear format, injected-beam crossed-field amplifier (IBCFA) for electronic warfare. The IBCFA should be capable of power output of 1000W peak, 200W average, between 8.5 and 17 GHz with 20dB gain. A laser-cut shaped-substrate meander line is used. The performance objectives for E/F band CFAs include 3kW peak pulse power output and 1kW average power output, 20dB gain, 2-4GHz, for electronic warfare; and 2kW peak pulse power output at 10-15% duty, 25dB gain, 3.0 to 3.6 GHz, for phased-array radar. The first E/F band tube built on this contract showed performance at low duty substantially like the previous CFA built with a laser-cut substrate when tested under electronic warfare conditions, and in addition performed well at 33% duty. For the phased array conditions, gain was too low. A second E/F band tube, built with a longer circuit to increase gain, failed when the substrate cracked and separated from the ground plane. An I/J band tube was built and tested. The sequence of construction of the circuit with laser cut substrate was revised to reduce breakage, and was demonstrated successfully. However, performance was poor primarily because of excessive RF losses in the circuit. GRA

N81-26398# Los Alamos Scientific Lab., N. Mex.

DEVELOPMENT OF INTEGRATED THERMIONIC CIRCUITS FOR HIGH-TEMPERATURE APPLICATIONS

J. Byron McCormick, Dale Wilde, Stephen Depp (IBM Research Lab., San Jose, Calif.), Douglas J. Hamilton (Arizona Univ., Tucson), William Kerwin (Arizona Univ., Tucson), Charles Derouin, Lorenzo Roybal, and Richard Dooley 1981 6 p refs Presented at High-Temp. Electron. Conf., Tucson, Ariz., 25-27 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-81-377; CONF-810316-4) Avail: NTIS HC A02/MF A01

A class of devices known as integrated thermionic circuits (ITC) capable of extended operation in ambient temperatures up to 500 C is described. The evolution of the ITC concept is discussed. A set of practical design and performance equations is demonstrated. Recent experimental results are discussed in which both devices and simple circuits have successfully operated in 500 C environments for extended periods of time. DOE

N81-26399# Argonne National Lab., Ill.

ANALOG AND DIGITAL-MULTISTAGE TIME-AVERAGING FILTERS

George E. Theodosiou and John W. Dawson 1980 19 p refs Presented at the Intern. Conf. on Exptn. at LEP, Uppsala, 16-20 Jun. 1980
(Contract W-31-109-eng-38)
(ANL/HEP/CP-80/34; CONF-800684-11) Avail: NTIS HC A02/MF A01

In time measurements involved in the detection of elementary particles using large counters, the time uncertainty introduced by the finite propagation velocity of the produced signal may be significant compared to the desired time resolution. A method, the essential ingredients of which are the time properties of delay lines and AND and OR logic gates, is introduced to reduce the effect. The basic circuit is described, and then the synthesis of time averaging filters, a four stage filter (implementation and testing), experimental results, and future applications are discussed. The problem of precise timing with a counter of large dimensions can also be solved by means of an analog method; the principle involved, implementation, testing, and time resolution and deadtime are considered. DOE

N81-26400# Los Alamos Scientific Lab., N. Mex.

VACUUM INTERRUPTERS AND THYRATRONS AS OPENING SWITCHES

E. M. Honig 1981 14 p refs Presented at Army Res. Office Workshop on Repetitive Opening Switches, Durango, Calif., 29 Jan. 1981
(Contract W-7405-eng-36)
(LA-UR-81-622; CONF-810778-3) Avail: NTIS HC A02/MF A01

High power opening switches for inductive storage for large scale energy storage applications are described. The triggered vacuum interrupter and the magnetically quenched thyratrons are discussed. By electrically retriggering the discharge in the vacuum interrupter between pulses, the dependence on mechanical motion is eliminated. This should enable repetition rate operation at 10 to 15 kHz while still maintaining the vacuum interrupter's proven interrupting performance of tens of kiloamps at tens of kilovolts. The magnetically quenched thyratron uses a cross magnetic field to raise the switch impedance by decreasing the electron mobility and driving the discharge into an arc chute wall where it is quenched. Attempts to understand the basic mechanisms involved and to increase the switch, ratings, and particularly the conduction time, are discussed. DOE

N81-26401# National Bureau of Standards, Washington, D.C.

GENERATION AND MEASUREMENT OF dc ELECTRIC FIELDS WITH SPACE CHARGE

Martin Misakian Nov. 1980 45 p refs
(Contract EA-77-01-6010)
(PB81-161929; NBSIR-80-2177) Avail: NTIS HC A03/MF A01 CSCL 09C

An experimental effort to generate known dc electric fields containing controlled amounts of space charge is described. An apparatus built for this purpose is described and two types of field probes currently used for transmission line field measurements are examined with the apparatus. Limitations on the operation of one type of probe in the presence of very large current densities are identified and discussed. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N81-26402* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
AUTOMATIC FLOWMETER CALIBRATION SYSTEM Patent
Raymond V. Lisle and Terry L. Wilson, inventor (to NASA) 24 Feb. 1981 5 p Filed 22 Jun. 1979 Supersedes N79-27479 (17 - 18, p 2409)
(NASA-Case-KSC-11076-1; US-Patent-4,253,156; US-Patent-Appl-SN-051274; US-Patent-Class-364-571; US-Patent-Class-364-510; US-Patent-Class-73-861) Avail: US Patent and Trademark Office CSCL 20D

A system for automatically calibrating the accuracy of a flowmeter is described. The system includes a calculator capable of performing mathematical functions responsive to receiving data signals and function command signals. A prover cylinder is provided for measuring the temperature, pressure, and time required for accumulating a predetermined volume of fluid. Along with these signals, signals representing the temperature and pressure of the fluid going into the meter are fed to a plurality of data registers. Under control of a progress controller, the data registers are read out and the information is fed through a data select circuit to the calculator. Command signals are also produced by a function select circuit and are fed to the calculator set indicating the desired function to be performed. The reading is then compared with the reading produced by the flowmeter.
Official Gazette of the U.S. Patent and Trademark Office

N81-26403 Cornell Univ., Ithaca, N. Y.
BOUNDARY INTEGRAL SOLUTIONS TO NEARLY HORIZONTAL FLOWS IN MULIPLY ZONED AQUIFERS Ph.D. Thesis
Olurinde Ebenezer Lafe 1981 158 p
Avail: Univ. Microfilms Order No. 8110921

A general purpose Boundary Integral Equation Method (BIEM) program was developed to solve nearly horizontal flows in multiply zoned, layered and leaky aquifers. A special technique is proposed to handle the large coefficient matrices which are obtained when the BIEM is applied to field problems. The technique involves condensing the matrix equations at the zonal levels before the final global assembling is done. Problems governed by equations with non zero right hand sides lead to BIEM formulation in which domain integrations are required. An automatic mesh generation scheme is proposed in order to maintain the ease of data preparation of the BIEM model. Two methods are proposed to solve the nonlinear equation with the BIEM. In the first method the equation is linearized around the average depth of the zone. The second method involves treating the nonlinear equation as a pseudo Poisson equation in which the right hand side is a function of the dependent variable. The BIEM model is applied to flow problems where analytical solutions are available and also to a groundwater basin in Taiwan. Dissert. Abstr.

N81-26404 City Univ. of New York, N. Y.
ENTRANCE EFFECTS IN STOKES FLOW THROUGH A PORE Ph.D. Thesis
Zeev Dagan 1981 216 p
Avail: Univ. Microfilms Order No. 8112752

The creeping motion through a pore of finite length and the motion of a sphere towards a circular aperture in a plane wall were studied. A solution technique was used that incorporates a newly developed procedure for handling axisymmetric flows in the presence of confining boundaries that do not conform to natural coordinate systems with an extension of the collocation technique previously developed for treating both bounded and unbounded three-dimensional multiparticle Stokes flow problems. Results show that in the limit of zero Stokes number the 'critical trajectory' concept for the exclusion of particles that is widely used in nuclepore filter theory is invalid. The present analysis indicates that when the hydrodynamic interaction of the particles with the wall of the pore is not neglected all particles will eventually enter the pore regardless of their initial position but that the time for each trajectory differs. Therefore, it is necessary to modify the critical trajectory concept using 'time dependent exclusion' description of particles approaching a pore. Dissert. Abstr.

N81-26405 Brown Univ., Providence, R. I.
THE VISCOSITY OF AQUEOUS SOLUTIONS Ph.D. Thesis
Robert James Correia 1980 129 p
Avail: Univ. Microfilms Order No. 8111089

The viscosity of aqueous solutions containing constitutents prevalent in geothermal brines is studied. The viscosity of single- and mutl component aqueous solutions is measured and a method is developed to describe the viscosity of geothermal brines as a function of the viscosity of the component solutions. An oscillating-disk viscometer was used to measure the viscosity of these solutions as a function of pressure, temperature, and concentration. Correlations as a function of pressure, temperature, and concentration are developed for the viscosity and density. The correlations reproduce the measured values to within the uncertainty of the latter. Comparisons are made with all the available data from other sources and agreement to within the accuracy quoted there is established. The data on the viscosity of multi-component solutions are compared to the values determined by the mixing rule which expressed the multi-component value in terms of the single-component data. This rule is extended to mixtures of ions and makes it possible to calculate the viscosity or density of one solution on the basis of data from other similar solutions. Dissert. Abstr.

N81-26406 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ANALYSIS OF HEAT TRANSFER AND MOISTURE DISTRIBUTION IN WETTED FIBER GLASS INSULATION MATERIALS Ph.D. Thesis
Ganesh Pandurang Bal 1980 126 p
Avail: Univ. Microfilms Order No. 8110449

Heat transfer and moisture distribution in a wet fiber glass insulation were investigated, using a thermal conductivity instrument consisting of heat flow meter with a guarded hot plate. Two distinct regimes of thermal conductivity were identified. Uniformly distributed moisture greatly increased the effective thermal conductivity of the insulation. The time required to approach steady moisture and temperature distributions was extremely long especially at higher moisture concentrations. The agreement between the moisture distribution was acceptable. It is suggested that the moisture distribution model gives the vapor flow induced by the temperature gradient which is the dominant mode of moisture transport in wet insulations. Dissert. Abstr.

N81-26407 California Univ., Davis.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF WATER SHEET JETS UNDER FORCED VIBRATION Ph.D. Thesis
Henry Richard Asare 1980 327 p
Avail: Univ. Microfilms Order No. 8111972

Experiments performed on vertical water sheet jets under forced vibration to simulate the liquid lithium waterfall are reported. The (1) nozzle forcing amplitude (A sub 0), (2) forcing frequency (f), (3) initial jet velocity (U sub 0), (4) initial jet thickness (b sub 0), and (5) ambient density (rho sub a) dependence on the wave amplitude growth was investigated. Nonlinear temporal stability theories describe the wave envelope amplitudes. The saturation (maximum) amplitudes are accurately predicted by the nonlinear theories. The linear temporal theory describes the wave envelope amplitudes in the linear regime were the sinsuoidal waveform is evident, however, the linear theory does not predict the saturation amplitude. Dissert. Abstr.

N81-26408 California Univ., Davis.
AN EXPERIMENTAL AND NUMERICAL STUDY OF STEADY FORCED-CONVECTION HEAT TRANSFER IN A SPHERICAL ANNULUS Ph.D. Thesis
Dean Byard Tuft 1980 115 p
Avail: Univ. Microfilms Order No. 8112027

Steady forced convection heat transfer in a spherical annulus with 50% C heated inner sphere was studied. Measurements of inner sphere heat flux rate distribution, flow separation angle, annulus fluid temperature and total heat transfer were made for

gap Reynolds numbers from 41 to 10886. The angle of separation along the inner sphere varies as a function of Reynolds number. Results of numerical calculations of laminar incompressible fluid flow and heat transfer in a spherical annulus are presented. The full transient axiymmetric Navier-Stokes equations in spherical coordinates are solved by an explicit finite-difference solution technique. Steady solutions are obtained by allowing the transient solution to achieve steady state. Separation angle was measured by nonvisual methods and varies as a function of Reynolds number. It is found that the computations predict the experimental trends and qualitative aspects of the flow and heat transfer and underpredict heat flux rates by a factor of two or more.
Dissert. Abstr.

N81-26409 Pittsburg Univ., Pa.
TWO-PHASE COCURRENT VERTICAL AIR-WATER FLOW IN RECTANGULAR DUCTS Ph.D. Thesis
Samir Farid Moujaes 1981 359 p
Avail: Univ. Microfilms Order No. 8112074

The two phase flow of air and water in rectangular channels was investigated. Double tipped optical fiber probes and hot film anemometers were used measure the local mean variables in such a flow. These include: gas void fraction, gas velocity and liquid velocity. The theoretical modeling test some of the constitutive relationships. A one dimensional two fluid model was presented as well as a fully developed one. It was found that single phase turbulent shear stress relations could be used to simulate shear in bubbly and slug flow for engineering purposes.
Dissert. Abstr.

N81-26410 North Carolina State Univ., Raleigh.
AN INVESTIGATION OF THE TRANSIENT LAMINAR FLOW HEAT TRANSFER AND PRESSURE DROP INSIDE HORIZONTAL CIRCULAR TUBES WITH FREEZING AT THE INNER WALL Ph.D. Thesis
David Douglas Jones, Jr. 1981 194 p
Avail: Univ. Microfilms Order No. 8111051

The transient freezing in tube flow under conditions of variable flow is presented. Dimensionless values of mass flow rate, heat transfer, and pressure loss across the freezing section are charted with time. Both steady state and transient analytical solutions disagree. The metastable condition of super cooling was observed in both steady state and transient experiments. Data and discussion are presented on this condition which can significantly alter freezing phenomena.
Dissert. Abstr.

N81-26411 City Univ. of New York, N. Y.
THEORETICAL AND EXPERIMENTAL STUDIES IN TRANSIENT MEMBRANE-FLUID FILM INTERACTIONS FOR SINGLE CELLS AND ASSEMBLAGES Ph.D. Thesis
Randall Wu 1981 138 p
Avail: Univ. Microfilms Order No. 8112748

A quantitative theoretical model was developed to describe the draining of a fluid film between a membrane bound fluid filled cell and a planar surface in an effort to understand the local mechanisms involved in the consolidating specimen. A bidirectional flow was set up in the lubricating layer due to an off axis pressure peak. However, this dual flow condition is not seen in elastohydrodynamic squeeze film thoery, where the maximum pressure is always located at the point of maximum deformation and the flow is directed radially outward everywhere. The bidirectional flow causes a gradual thickening of the film in the central region and the formulation of a narrow gap region of high curvature near the edge of the near contact area where the flow is directed radially outward. On the large time scale, after the fluid trapping has been achieved, the off axis pressure peak is replaced by a characteristic pressure plateau in the region of the near contact area. During this large time period changes in the flow behavior are characterized by a nearly constant edge region greatly diminished velocities in the lubricating film. It is shown that the membrane boundary increases draining time by several order of magnitude when the initial film thickness is two or more orders of magnitude smaller than the typical cell size.
Dissert. Abstr.

N81-26412 Oregon State Univ., Corvallis.
HEAT TRANSFER IN MAGNETIC FLUIDS AT LOW REYNOLDS NUMBER Ph.D. Thesis
Sang Hyouk Choi 1981 172 p
Avail: Univ. Microfilms Order No. 8112902

The flow of a magnetic self propelled ferrohydrodynamic fluid in a horizontal circular tube subjected to axially varying temperature and magnetic field was studied. The analytical solution to the governing equations for the velocity and temperature profiles within the fully develoed flow region of the duct is presented. The Nusselt number was found to be a function of a magnetic Rayleigh number. An experimental investigation of flow at the thermal entry region caused by a change in tube wall heat flux is described. A numerical solution to the governing equations is presented. A hot wir anemometer was used for velocity measurements. The experimentally and numerically obtained velocity and temperature profiles generally agreed in magnitude and shape but a shift in maximum velocity point location was observed.
Dissert. Abstr.

N81-26413 Cornell Univ., Ithaca, N. Y.
CONTRIBUTION TO THE THEORY AND MODELLING OF INTERFACE-RELATED PHENOMENA IN INTERMITTENT TURBULENT FLOWS Ph.D. Thesis
Jacques Lewalle 1981 137 p
Avail: Univ. Microfilms Order No. 8110923

Turbulent laminar interfaces, definition and detection, local dynamic of entrainment, topography and the global spreading of turbulent flow were studied. The intermittency in the dissipative regions of isotropic turbulence reflects on the accuracy of the detection scheme. The local interface dynamics are discussed. Turbulent pressure fluctuations amplify the mean vorticity by stretching. The entrainment from evolution equation for the intermittency factor gamma was studied. The large and small scale parameters use factorization of the flow properties to which they correspond. The global entrainment rate is independent of the increase of surface area by folding. The model preserves the intermittency profile with very good accuracy in several flow types. Parametrization of the intermittent properties in shear properties is systematic and covers both ends of the turbulent spectrum.
Dissert. Abstr.

N81-26414 Case Western Reserve Univ., Cleveland, Ohio.
NON-LINEAR FLOW IN A POROUS MEDIUM Ph.D. Thesis
Nicholas David Rosenstein 1980 207 p
Avail: Univ. Microfilms Order No. 8108319

Three dimensional steady flow of a viscous, incompressible, Newtonian fluid in a porous medium was investigated experimentally and numerically. Tests were performed to investigate: (1) patterns of three dimensional flow in a porous medium; (2) the nature of the transition from creeping (Darcy, viscous) flow to the nonlinear flow; (3) fluid mechanic mechanisms responsible for such transitions; (4) limitations for linear or Darcy flow regimes; (5) a basis for analytical modeling of the transition in a porous medium. It is concluded that the results provide important aspects for experimental numerical and analytical methods of investigation of the flow in a porous medium as well as for physical understanding and graphical presentation.
Dissert. Abstr.

N81-26415 Texas Univ. at Arlington.
NATURAL CONVECTION IN POROUS MEDIA HEATED FROM ABOVE Ph.D. Thesis
James Ralph Leith 1980 190 p
Avail: Univ. Microfilms Order No. 8111707

Transient natural convection in horizontal porous media is analyzed for geometries with permeable boundaries, and with upper boundary heating. A mathematical model is postulated for porous layers in which continuously stable density gradients exclude the problem of marginal stability. In natural convection, temperature coupling through buoyancy is exhibited in the governing partial differential equations of the mathematical model for mixed mode heat transfer. Corresponding asymptotic solutions for small and large Rayleigh number exhibit negligible momentum energy coupling. The system model is descriptive of conduction opposed natural convection heat transfer, with a continuous applicable range of driving force. Effectiveness of the one dimensional system model is demonstrated in numerical simulation of heat transfer in a packed bed of uniform spheres. Time dependent heating and interface radiation to the environment

are considered in the mathematical model of a physical system with large solid to fluid phase conductivity ratio. It is indicated that effective conductivity should be determined by nothing the initial stages of transient response, whereas effective interface emissivity should be inferred from the large time response. This method internal convection and radiant exchange with the environment. Dissert. Abstr.

N81-26416 Michigan Technological Univ., Houghton.
MATHEMATICAL MODELING IN GAS-LIQUID SYSTEMS Ph.D. Thesis
Hossein Assadipour 1980 106 p
Avail: Univ. Microfilms Order No. 8107136

A mathematical model describing bubble formation in inviscid liquids is developed. Regions of constant flow and constant pressure bubble formation predicted by the model are in good agreement with experimental data for an aqueous system. Comparisons of characterization data obtained expermentally with those predicted by the model show that there is close agreement under low flow rate conditions. A mathematical model explaining the kinetics of argon decarburization in the production of stainless steel is developed. The model postulates a specific mechanism based on the dominant chemical reaction during argon decarburization and a dynamic mass balance for oxygen and carbon. This allows the development of a rate expression which is a pseudo second order type. The results obtained from the model are compared with expermental data and close agreement is observed. Dissert. Abstr.

N81-26417*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.
SOME OBSERVATIONS OF FLOW STRUCTURE IN MULTIPLE JET MIXING
A. Krothapalli, D. Baganoff, and K. Karamcheti Mar. 1979 10 p refs Presented at the 2nd Symp. on Turbulent Shear Flows, London, 2-4 Jul. 1979
(Contract NASw-2233)
(NASA-CR-166179; SU-JIAA-TR-19) Avail: NTIS HC A02/MF A01 CSCL 20D

Results of hot wire measurements in an incompressible jet issuing from an array of rectangular lobes, equally spaced with their small dimensions in a line, both as a free jet, and as a confined jet, are presented. In the case of a multiple free jet, the flow field for downstream distance x greater than 60D (D = width of a lobe) resembles that of a jet exiting from a two-dimensional nozzle with its short dimension being the long dimension of the lobe. The field of turbulence is found to be nearly isotropic in the plane containing the small dimension of the lobes for x greater than 60D. In the case of a confined multiple jet, the flow field is observed to be nearly homogeneous and isotropic for x greater than 60D. S.F.

N81-26418# Wisconsin Univ. - Madison. Mathematics Research Center.
UNIQUENESS OF THE SOLUTIONS OF (U SUB T) -(DELTA (THI (U))) = 0 WITH INITIAL DATUM A MEASURE
Michel Pierre Jan. 1981 30 p refs
(Contract DAAG29-80-C-0041; Grant NSF MCS-79-27062)
(AD-A099359; MRC-TSR-2171) Avail: NTIS HC A03/MF A01 CSCL 12/1

The uniqueness property for solutions of an initial-value problem turns out to be a fundamental tool which interacts with many other questions of a qualitative nature. For an evolution equation that is supposed to serve as a model for a natural phenomenon, it is often crucial if one wants the model to be credible. The variety of these applications explains the abundant literature concerning uniqueness for such problems. This paper is a new contribution to this question. It deals with the case when the initial datum is a measure, (E) being understood in the sense of distributions. Thanks to this general setting, it recovers most of the previous results and takes into account a larger number of physical models. But its main interest comes from the fact that it solves the 'right' uniqueness question in a form which arises in many other related questions. For instance the study of the asymptotic behavior of the solutions of (E) can be reduced to this type of a uniqueness problem with a Dirac mass as initial datum. GRA

N81-26419# Northwestern Univ., Evanston, Ill.
GASDYNAMICS OF VERY SMALL LAVAL NOZZLES Interim Report
Oommen Abraham, Jack H. Binn (Midwesco Corp., Chicago), Barry G. DeBoer (GTE Sylvania Lab., Salem, Mass.), and Gilbert D. Stein Apr. 1981 24 p refs Submitted for publication
(Contract N00014-79-C-0622; NR Proj. 056-729)
(AD-A098874; TR-2) Avail: NTIS HC A02/MF A01 CSCL 14/2

An investigation of diverging supersonic nozzles with throat diameters in the range of 0.025 to 0.25 mm has been carried out using gasdynamic measurements for a variety of gases and mixtures with sulfur hexafluoride. Due to the small nozzle size, boundary layers, although thin, may constitute a major fraction of the flow or, indeed at low pressures, may be fully developed. Nevertheless these nozzles have been shown to be very efficient for production of clusters condensed from the expanding gas. They produce orders of magnitude increases in molecular beam intensities, relative to the conventional, isentropic free jet sources. The effects of gas properties and nozzle design on performance have been analyzed and compared to theoretical solutions to the governing equations of motion including cluster nucleation and growth. Author (GRA)

N81-26420# Pennsylvania State Univ., University Park.
TRAVELLING BUBBLE CAVITATION AND RESULTING NOiSE M.S. Thesis - May 1981
Mark F. Hamilton 2 Mar. 1981 138 p refs
(Contract N00024-79-C-6043)
(AD-A099409; ARL/PSU/TM-81-76) Avail: NTIS HC A07/MF A01 CSCL 20/1

Many theories describing cavitation noise model the phenomenon by considering the independent annihilation of cavities in an infinite fluid. Since most practical applications involve cavitation generated by the dynamical action of flow, it is valuable to know how these theories will compare with such experimental data. In this investigation, a Schiebe body is employed as a headform that supports travelling bubble cavitation which is analyzed with regard to the various theories. High-speed films were taken of bubbles collapsing on the headform while the accompanying noise signal was recorded. These results showed rebounds to generate almost as much noise as the initial collapse. By counting the number of noise bursts occurring for given noise level and flow parameters, it was found that the noise energy per bubble varies with the cavitation number as roughly sigma to the -8 power above 10 kHz, but not at all with the free stream flow velocity V sub infinity between 30 and 40 fps. The spectral energy density was observed to be flat, regardless of sigma and V sub infinity, from 10 to 100 kHz. Although maximum bubble radii as functions of sigma and V sub infinity were not adequately measured during this study, it is clear that an understanding of this parameter is critical to any cavitation noise theory. GRA

N81-26421# Army Military Personnel Center, Alexandria, Va.
THE EFFECT OF PARTICLE SIZE ON RADIATIVE HEAT TRANSFER IN HIGH TEMPERATURE FLUIDIZED BEDS M.S. Thesis - Lehigh Univ. Final Report
Thomas Robert Frankenfield 1 May 1981 124 p refs
(AD-A099037) Avail: NTIS HC A06/MF A01 CSCL 20/3

The effect of particle size on the radiative component of heat transfer in high temperature fluidized beds is examined. One radiometer probe is used to measure both the total and radiative components of heat flux. Two sizes of silica sand particles are tested at bed temperatures of 200 to 750 C. The radiation heat flux, percentage of total heat flux due to radiation, total heat transfer coefficient, radiative heat transfer coefficient, and bed emissivity are the parameters considered. The radiative heat flux does not vary with particle size, and the values obtained agree with those of previous studies. The percentage of total heat transfer due to radiation is found to be significant for bed temperatures greater than 400 C and increases with increasing particle size. At 750 C, the radiative component is 20% of the total heat flux for small particles and 30% for the larger particles. The smaller particles have a larger total heat transfer coefficient than the large particles at all bed temperatures. When the fluidizing velocity is increased, the total heat transfer coefficient decreases for both particle sizes. The radiative heat transfer coefficient has

the same values for both particle types at all bed temperatures. The emissivity of the bed is larger for the large particles at all temperatures but always remains less than one. GRA

N81-26422# Wisconsin Univ. - Madison. Mathematics Research Center.

REGULARIZING EFFECTS FOR U SUB T + A PSI(u) = 0 IN L1 VECTOR SPACE Technical Summary Report

Michael G. Crandall and Michel Pierre Mar. 1981 26 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-79-27062)

(AD-A099349; MRC-TSR-2187) Avail: NTIS HC A03/MF A01 CSCL 12/1

Various initial-boundary value problems and Cauchy problems can be written in the form du/dt A(psi (u))=0 where psi=R approaches R is nondecreasing and A is the linear generator to strongly continuous nonexpansive semigroup e to the -ta power in a L1 vector space. Many models of interesting phenomena yield equations for the evolution of a system of this abstract form where psi is a nonlinear nondecreasing function and A is an operator, e.g., A may be the Laplacian (perhaps under boundary conditions) or A may be del/del x, while psi may be a power law. Models like this occur in porous flow, plasmas and conservation laws. In this work it is shown that a broad class of such problems are solvable by the nonlinear semigroup theory. The main point, however, is a regularizing effect which estimates the speed of the system at time t = 0 by the integral of the initial data. This has consequences for the regularity of the solutions of concrete problems and their asymptotic behavior. GRA

N81-26423# Wisconsin Univ. - Madison. Mathematics Research Center.

A QUASILINEAR PARABOLIC EQUATION DESCRIBING THE ELONGATION OF THIN FILAMENTS OF POLYMERIC LIQUIDS Technical Summary Report

M. Renardy Feb. 1981 27 p refs

(Contract DAAG29-80-C-0041)

(AD-A099345; MRC-TSR-2183) Avail: NTIS HC A03/MF A01 CSCL 20/4

The equation describes the elongation of a filament of a polymeric liquid subjected to a force f at both ends. The liquid is assumed to satisfy certain accepted 'rubberlike liquid' constitutive relations, and the filament is assumed to be thin, which permits reduction of the problem to one space dimension. The unknown variable u denotes the position of a fluid particle at time t, which was at position x at = - infinity, we have u(x, - infinity) = x. The equation fits into the framework of the general mathematical theory for quasilinear parabolic equations. This proves that for any given 'initial condition' a solution exists at least on a certain time interval. Moreover, we shall prove that for forces f(t), which approach zero exponentially for t approaches + or - infinity and are small in a suitable sense, there is a solution for all times t, - infinity < t < + infinity, and this solution approaches a stationary limit as t approaches + infinity. GRA

N81-26424# Wisconsin Univ. - Madison. Mathematical Research Center.

UPWIND DIFFERENCE SCHEMES FOR SYSTEMS OF CONSERVATION LAWS: POTENTIAL FLOW EQUATIONS

Bjorn Engquist (California Univ.) and Stanley Osher (California Univ.) Mar. 1981 51 p refs

(Contracts DAAG29-80-C-0041; NCA2-OR390-002)

(AD-A099348; MRC-TSR-2186) Avail: NTIS HC A04/MF A01 CSCL 12/1

We derive new upwind type finite difference approximations to systems of nonlinear hyperbolic conservation laws. The general technique is exemplified by the potential flow equations written as a first order system. The scheme has desirable properties for shock calculations. For the potential flow approximation, we show that the entropy condition is valid for limit solutions and that there exist discrete steady shocks which are unique and sharp. Numerical examples are given. Author (GRA)

N81-26425# Wisconsin Univ. - Madison. Mathematics Research Center.

STEADY FLOWS DRAWN FROM A STABLY STRATIFIED RESERVOIR

T. Brooke Benjamin (Mathematical Inst., Oxford, England) Mar. 1981 40 p refs

(Contract DAAG29-80-C-0041)

(AD-A099370; MRC-TSR-2181) Avail: NTIS HC A03/MF A01 CSCL 20/4

Perfect-fluid theory is applied to the description of steady motions that can be generated as the outflow into a horizontal channel from a large reservoir of incompressible heavy fluid whose density is an arbitrary decreasing function of height. A particular aim is to pinpoint the significance of an already known class of flows, called self similar, which satisfy the approximate (shallow-water) equations applicable when the horizontal scale of the motion greatly exceeds its vertical scale, but which have not until now been shown to match the downstream conditions that primarily determine the motion in practice. New variational principles are introduced characterizing the class of self-similar flows: in Section 2 there is a characterization in terms of flow force among parallel flows realized asymptotically in a uniform channel, in Section 3 among a wider range of possibilities including periodic flows, and in Section 6 among supercritical flows realized in a convergent-divergent channel. Aspects of general flows in channels of gradually varying breadth are treated in Sections 4 and 5, including the remarkable fact, proven in Section 5, that every steady flow outside but close to the self-similar class must somewhere undergo a local crisis unaccountable by the shallow-water approximation. Practical interpretations afforded by the theoretical results are noted in Section 7. Author (GRA)

N81-26426# Catholic Univ. of America, Washington, D.C. Dept. of Mechanical Engineering.

RECENT DEVELOPMENT IN FLOW SEPARATION Final Report, Jun. 1978 - May 1980

Paul K. Chang May 1980 514 p refs

(Grant AF-AFOSR-3636-78; AF Proj. 2307)

(AD-A099165; AFOSR-81-0451TR) Avail: NTIS HC A22/MF A01 CSCL 20/4

A review and evaluation of recent Russian scientific literature on flow separation has been completed. The principal material reviewed were the papers appearing in NASA TTF 117 as well as two books Gradient and Separated Flows (1976) and Gas Dynamics of Near Wake (1976). This research activity has been related to separated flow research in the West. A book in 24 chapters has been prepared with the following major sections: Analysis of Flow Separation, Incompressible Flow Separation, Compressible Flow Separation, Base Flow and Wake, Thermal effects on Flow Separation and Reattachment, Separated Flow Affected by Annular Outflow and Separated Flow Control. Author (GRA)

N81-26427# Virginia Univ., Charlottesville.

MODERN GAS CENTRIFUGE AND RAREFIED-GAS DYNAMICS

R. A. Lowry, E. V. Halle, and H. G. Wood, III 30 Mar. 1981 40 p refs Presented at the 12th Intern. Symp. on Rarefield Gas Dyn., Charlottesville, Va., 7 Jul. 1980 Prepared in cooperation with Union Carbide Corp., Oak Ridge, Tenn.

(Contract W-7405-eng-26)

(K/OA-4722; CONF-800715-6) Avail: NTIS HC A03/MF A01

The modern gas centrifuge appears to be the preferred method for the enrichment of the isotopes of uranium on a commercial scale. Centrifuge problems involving rarefield gas dynamics considerations are discussed. DOE

N81-26428# Illinois Univ. at Urbana-Champaign. Water Resources Center.

MEASUREMENTS IN MERGING FLOW Final Report

W. Hall, C. Maxwell, and Arni Snorrason Jan. 1981 47 p refs

(Contract DI-14-34-0001-0115)

(PB81-163545; UILU-WRC-81-0155; W81-01490; OWRT-A-103-ILL(1)) Avail: NTIS HC A03/MF A01 CSCL 20D

Time average velocity magnitudes and directions of two intersecting submerged turbulent air jets of approximately equal strengths were measured. A three dimensional pitot-type probe was used. Measurements were taken in the plane of the nozzles, and cross sectional data was obtained at four stations, three of

these being in the observed reverse flow. It is shown that the reverse flow spreads much more rapidly perpendicular to the nozzle plane than in the nozzle plane, whereas the forward flow is fairly symmetric. Similarity profiles were found in both the forward and reverse flows. In the forward flow the distribution was essentially Gaussian. This was also true in the backward flow in the direction normal to the plane of the nozzles. In the plane of the nozzles the backward flow profiles were close to semi-elliptical or semicircular, depending on the scales for plotting. GRA

N81-26429# Water and Power Resources Service, Denver, Colo. Engneering and Research Center.
AIR-WATER FLOW IN HYDRAULIC STRUCTURES
Henry T. Falvey Dec. 1980 150 p refs
(PB81-163370; ENGINEERING-MONO-41) Avail: NTIS HC A07/MF A01 CSCL 20D

Air entrainment and air demand in both open and closed conduit flows was investigated. A concise reference source from which design manuals, monographs, and charts for specific applications could be prepared was produced. Areas for additional research are identified. Available reference material in several areas, and data from several references were combined to produce generalized curves. GRA

N81-26430*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mining and Minerals Engineering.
NEAR-WALL SIMILARITY IN A PRESSURE-DRIVEN THREE-DIMENSIONAL TURBULENT BOUNDARY LAYER
F. J. Pierce and J. E. McAllister Sep. 1980 242 p refs
(Grant NsG-2301)
(NASA-CR-164421; PB81-156960; VPI-E-80.32) Avail: NTIS HC A11/MF A01 CSCL 20D

Mean velocity, measured wall pressure and wall shear stress fields were made in a three dimensional pressure-driven turbulent boundary layer created by a cylinder with trailing edge placed normal to a flat plate floor. The direct force wall shear stress measurements were made with floating element direct force sensing shear meter that responded to both the magnitude and direction of the local wall shear stress. The ability of 10 near wall similarity models to describe the near wall velocity field for the measured flow under a wide range of skewing conditions and a variety of pressure gradient and wall shear vector orientations was used. GRA

N81-26038# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
COMPUTATION OF FLOWS INCLUDING STRONG VISCOUS INTERACTIONS WITH COUPLING METHODS
J. C. LeBalleur *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 36 p refs In FRENCH; ENGLISH summary (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26049# National Aerospace Lab., Amsterdam (Netherlands).
THE CALCULATION OF INCOMPRESSIBLE BOUNDARY LAYERS WITH STRONG VISCOUS-INVISCID INTERACTION
A. E. P. Veldman *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 12 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26050*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A VISCOUS-INVISCID INTERACTION MODEL OF JET ENTRAINMENT
R. G. Wilmoth and S. M. Dash (Aeronautical Research Associates of Princeton, Inc.) *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 15 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01 CSCL 20D

N81-26051# Centre d'Etudes et de Recherches, Toulouse (France). Dept. d'Aerothermodynamique.
THE ANALOGY OF SINGULARITIES IN DIRECT METHODS FOR CALCULATING STEADY THREE DIMENSIONAL AND UNSTEADY TWO DIMENSIONAL BOUNDARY LAYERS: ANALYSIS OF REVERSED MODES [ANALOGIE DES SINGULARITES DANS LES METHODES DIRECTES DE CALCUL DES COUCHES LIMITES TRIDIMENSIONNELLE STATIONNAIRE ET BIDIMENSIONNELLE INSTATIONNAIRE: ANALYSE DES MODES INVERSES]
J. Cousteix and R. Houdeville *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 14 p refs In FRENCH; ENGLISH summary (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26054# Karlsruhe Univ. (West Germany). Inst. fuer Stroemungslehre und Stroemungsmaschinen.
NORMAL SHOCK-TURBULENT BOUNDARY LAYER INTERACTION
R. Bohning and J. Zierep *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 8 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26059# Stanford Univ., Calif. Dept. of Mechanical Engineering.
THE 1980-81 AFOSR-HTTM-STANFORD CONFERENCE ON COMPLEX TURBULENT FLOWS: COMPARISON OF COMPUTATION AND EXPERIMENT
S. J. Kline *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 22 p refs (For primary document see N81-26037 17-01)
(Contract F49620-80-C-0027)
Avail: NTIS HC A22/MF A01

N81-26060# Ruhr Univ., Bochum (West Germany). Inst. fuer Thermo- und Fluiddynamik.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF TWO DIMENSIONAL FLOWS WITH SEPARATED REGIONS OF FINITE LENGTH
K. Gersten, H. Herwig, and P. Wauschkuhn *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 13 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

N81-26061# Sandia Labs., Livermore, Calif.
TWO DIMENSIONAL SEPARATED FLOW: EXPERIMENT AND DISCRETE VORTEX DYNAMICS SIMULATION
W. T. Ashurst, F. Durst (Karlsruhe Univ.), and C. Tropea (Karlsruhe Univ.) *In* AGARD Computation of Viscous-Inviscid Interactions Feb. 1981 13 p refs (For primary document see N81-26037 17-01)
Avail: NTIS HC A22/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N81-26431* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
THERMOCOUPLE, MULTIPLE JUNCTION REFERENCE OVEN
Louis P. LeBlanc, inventor (to NASA) 28 Apr. 1981 5 p Filed 20 Feb. 1980 Supersedes N80-19469 (18 - 10, p 1293)
(NASA-Case-FRC-10112-1; US-Patent-4,264,802; US-Patent-Appl-SN-122965; US-Patent-Class-219-210; US-Patent-Class-73-361; US-Patent-Class-219-209; US-Patent-Class-219-510; US-Patent-Class-361-334; US-Patent-Class-236-1F) Avail: US Patent and Trademark Office CSCL 14B

An improved oven for maintaining the junctions of a plurality of reference thermocouples at a common and constant temperature is described. The oven is characterized by a cylindrical body

defining a heat sink with axially extended-cylindrical cavity a singularized heating element which comprises a unitary cylindrical heating element consisting of a resistance heating coil wound about the surface of metallic spool with an axial bore defined and seated in the cavity. Other features of the oven include an annular array of radially extended bores defined in the cylindrical body and a plurality of reference thermocouple junctions seated in the bores in uniformly spaced relation with the heating element, and a temperature sensing device seated in the axial bore for detecting temperature changes as they occur in the spool and circuit to apply a voltage across the coil in response to detected drops in temperatures of the spool.

Offical Gazette of U.S. Patent and Trademark Office

N81-26432# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

SCANNING AUGER AND WORK-FUNCTION MEASUREMENTS APPLIED TO DISPENSER CATHODES

Genghmun Eng and H. K. Alan Kan 1 May 1981 29 p refs (Contract F04701-80-C-0081)

(AD-A099413; TR-0081(6970-02)-1; SD-TR-81-35) Avail: NTIS HC A03/MF A01 CSCL 14/2

A method to perform spatially resolved work-function measurements has been developed using a modified scanning Auger microprobe (SAM). The basis of the method is that patches of different work function give rise to different onsets of secondary electron emission. The combined SAM-work function measurement method permits a microscopic correlation of emissive or surface dipole properties with elemental composition. The system permits a surface spatial resolution of 0.2 micrometer provided by the focused incident electron beam, and a work-function resolution of better than 0.05 eV. Results are presented for elemental samples, which were used as a test of the work-function mapping ability. Some initial results on dispenser cathode surfaces are also presented. Author (GRA)

N81-26433# Materials Research Labs., Ascot Vale (Australia).

DEVELOPMENT AND EVALUATION OF AN AUTOMATIC FRAGMENT-WEIGHTING APPARATUS

N. M. Burman Dec. 1980 23 p refs

(AD-A099292; MRL-R-803; AR-002-388) Avail: NTIS HC A02/MF A01 CSCL 14/2

An electromechanical system has been designed and built to automatically measure and record the weights of large numbers of small fragments produced during the explosive testing of material. The results of the automatic weighing of fragments from several test cylinders are shown to compare favorably with those obtained by manual weighing. Author (GRA)

N81-26434# Los Alamos Scientific Lab., N. Mex.

PULSED VERSUS DIRECT CURRENT CALIBRATION OF A PROXIMITY FOCUSED X-RAY STREAK CAMERA

P. D. Rockett and John S. McGurn Feb. 1981 7 p refs (Contract W-7405-eng-36)

(LA-8425-MS) Avail: NTIS HC A02/MF A01

The absolute sensitivity of a proximity focused X-ray streak tube was measured with dc Henke tube X-ray line sources. Calibration covered the photon energy range from 0.930 to 8.05 keV at five points. A pulsed comparison was performed using a laser plasma X-ray source. The calculated camera sensitivity was folded with the measured spectrum and compared to measured film exposures. The predicted exposures were 6.5 times less than the measured exposures, verifying that the proximity focused tube response is nonlinear with flux at low, dc flux levels. Results of dc recalibrations that varied flux levels determined the extent of this phenomenon. DOE

N81-26435# Argonne National Lab., Ill. High Energy Physics Div.

FIFTY MeV POLARIMETER

Harold Spinka 1980 38 p refs

(Contract W-31-109-eng-38)

(ANL/HEP/PR-80/02) Avail: NTIS HC A03/MF A01

A description is given of the construction, operation and calibration of the MeV polarimeter which was used at the zero gradient synchrotron. The dependence of the observed counts on various parameters, including the beam polarization, beam intensity and the solid angle in the two polarimeter arms, is also discussed. DOE

N81-26436# Los Alamos Scientific Lab., N. Mex.

MEASURING SPHERICITY ON A ROUNDNESS GAGE

Allen L. Gauler 1980 20 p refs Presented at the 52nd Meeting of the IMOG Gaging Subgroup, Los Alamos, N. Mex., 21 Oct. 1980

(Contract W-7405-eng-36)

(LA-UR-81-513; CONF-8010160-1) Avail: NTIS HC A02/MF A01

The three dimensional geometry of a spherical object may be determined by evaluation of a number of two dimensional roundness measurements which have a known orientation with respect to one another. A suitable set of orientations appears to be one in which the plane of each roundness measurement coincides with every other such plane along a single diameter of the sphere. A device for producing the required set of orientations, adaptable to spheres of varying diameters and designed to avoid damage to delicate materials, was developed and tested. DOE

N81-26437# Missouri Univ. -Columbia.

NEUTRON TIME-OF-FLIGHT DIFFRACTOMETER WITH A LINEAR-POSITION SENSITIVE DETECTOR

A. M. Balagurov, V. L. Gordelii, M. E. Ishmukhametov, and V. D. Novozhilov 1980 18 p refs Transl. into ENGLISH of Report No. JINR-P13-80-440 Joint Inst. for Nuclear Research, Dubna, 1980 Prepared in cooperation with Argonne National Lab. Submitted for publication

(ANL-Trans-1194; JINR-P13-80-440) Avail: NTIS HC A02/MF A01

A method for recording two dimensional neutron diffraction patterns as a function of the scattering angle and the wavelength of the diffracted neutrons is described, and its results have been examined on a pulsed neutron source, the IBR-30 reactor. The position sensitive detector is composed of an SNM-41 (7 atmosphere helium-3) proportional counter in which high resistance nichrome wire is used as the anode. The determination of the coordinates of the neutron event in the detector is performed using two analog-to-digital converters which analyze the amplitudes of the pulses at each end of the anode wire, and with a special device (a dedicated processor) which includes a scheme for division using digital arithmetic. Tests performed on the IBR-30 reactor have shown that two-dimensional neutron diffraction data shorten the duration of the experiment (by about 20 times) and improve the quaity of the diffraction patterns. DOE

N81-26438# Los Alamos Scientific Lab., N. Mex.

THE 100-kV, 2-ns RISETIME, dc-COUPLED PROBE

J. Power, W. Nunnally, and D. Young 1981 8 p Presented to the Workshop on Elec. Meas. in Pulse Power Systems, Boulder, Colo., 2-4 Mar. 1981

(Contract W-7405-eng-36)

(LA-UR-81-582; CONF-810325-3) Avail: NTIS HC A02/MF A01

A high voltage probe was designed and constructed; it may be used for both high voltage dc and for transient measurements. The probe is rated at 100 kV dc with a short transient rating of 150 kV peak. System risetime is less than 2 ns. The input impedance is 1000 M-ohm shunted by 13 pF. A distributed RC network providing the desired attenuation is housed in a 25.4 cm dia cylindrical housing. A 15.2 m length of coaxial cable connects the probe to a termination network at the oscilloscope input. The oscilloscope input impedance must be at least 100-ohm to maintain the correct dc attenuation ratio. DOE

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-26439 Brown Univ., Providence, R. I.

ULTRA-SHORT SUBMILLIMETER WAVE GENERATION IN OPTICALLY PUMPED MOLECULAR GASES Ph.D. Thesis

Wayne Clark Lemley 1980 148 p

Avail: Univ. Microfilms Order No. 8111135

Synchronous pumping from a modelocked TEA CO2 laser was used to generate high intensity far infrared pulses in CH3F, D2O and NH3 at peak powers exceeding 100 kW in some cases. By employing an optical correlation measurement technique, pulse widths as short as 355 picoseconds were observed. The dependence of submillimeter pulse duration and shape on detuning of synchronous cavity length, pressure variations and pump pulses was investigated. The relative arrival times of pump and submillimeter pulses also were determined for various circumstances. Some theoretical considerations from fundamental quantum mechanical principles applied to a three level system were used to examine the possible origin of the apparent large gain bandwidths necessary to support such short pulses.

Dissert. Abstr.

N81-26440 Cornell Univ., Ithaca, N. Y.

SUB-NANOSECOND TIME-RESOLVED EMISSION STUDIES WITH A MODE-LOCKED CW DYE LASER Ph.D. Thesis

Mitchell Dale Hirsch 1981 151 p

Avail: Univ. Microfilms Order No. 8110956

A technique is developed for time-resolved observation of light emission in the picosecond regime. The technique makes use of optical sum-frequency generation in a crystal having a high non-linear optical dielectric coefficient. The crystal acts as a shutter and provides a time resolution which is limited only by the duration of the light pulses used in the measurement. This technique is used in two studies of time-resolved emission from molecules in solution. In the first of these, emission decay curves are obtained for the dye malachite green in solutions of different viscosity. The intensity of emission within the first 10 picoseconds following excitation of the molecule is itself observed to decrease with decreasing viscosity. In the second study a decay time of 14 + or - 3 picoseconds is measured for emission at room temperature from the molecule bacteriorhodopsin, obtained from the purple membrane of the bacterium Halobacterium Halobium. Dissert. Abstr.

N81-26441# Naval Research Lab., Washington, D. C. Plasma Theory Branch.

LINEAR AND NONLINEAR ELECTRON CYCLOTRON INTERACTION IN OPEN RESONATORS Interim Report

J. L. Vomvoridis (JAYCOR) and P. Sprangle 7 May 1981 58 p refs Sponsored in part by DOE

(AD-A098885; NRL-MR-4459) Avail: NTIS HC A04/MF A01 CSCL 20/5

In this work the electron cyclotron maser oscillator interaction is analyzed in an open resonator configuration. One of the salient features of this configuration for generating high power short wavelength radiation is its ability to mode select. Both the linear and nonlinear analysis are developed for an arbitrary value of the refractive index n = kc/w. Specializing to luminous waves, as n goes to 1, it is shown that the linear gain curve is symmetric about synchronism and that instability can occur even at exact synchronism, for appropriate initial beam distributions. The nonlinear integrals of the motion are obtained, indicating that the total energy is available, the nonlinear evolution is described by a single differential equation, and the nonlinear efficiency is shown to depend on only four combinations of the beam, field, and resonator parameters. Nonlinear efficiencies up to 15% can be achieved. For a relativistic beam, a substantial frequency upshift is possible, with efficiencies up to 10%. Efficiency enhancement is possible, e.g., by the introduction of a two-stage resonator. In such a configuration, efficiencies exceeding 30% are calculated. Finally, the requirements for beam temperature and mode selectivity are found not to be particularly restrictive. Author (GRA)

N81-26442# Aerospace Corp., El Segundo, Calif.

MODELING OF THE H + NF2 REACTIVE FLOW Interim Report

J. M. Herbelin, M. A. Kwok, and N. Cohen 15 Apr. 1981 22 p refs

(Contract F04701-80-C-0081)

(AD-A098956; TR-0081(6610)-1; SD-TR-81-21) Avail: NTIS HC A02/MF A01 CSCL 20/10

The electronically excited species NF(a 1 Delta) and NF(b 1 Sigma +) are produced, respectively, by the reaction of discharge-produced NF2 radicals with H atoms and subsequent energy-transfer processes with vibrationally excited HF molecules in a medium-pressure flow tube. Use of the recently measured transfer and other reactive cross-sections has made it possible to achieve good agreement between the computed and measured populations of these two species along the flow distance. This agreement indicates a value for the rate coefficient for H + NF2 yields HF + NF(a 1 Delta) of 2.0 x 10 to the 13th power cc/mol-sec; for the transfer HF(3) + NF(a 1 Delta) yields HF(1) + NF(b 1 Sigma), a value of 6.0 x 10 to the 13th power cc/mol-sec at room temperature is indicated. The analysis also provides an indirect determination of the radiative lifetime of the NF(a 1 Delta) between 0.6 and 1 sec. Author (GRA)

N81-26443# Aerospace Corp., El Segundo, Calif. Aerophysical Lab.

INVESTIGATION OF DF KINETICS IN THE PRESENCE OF BF3

J. F. Bott and M. Epstein 2 Apr. 1981 16 p refs

(Contract F04701-80-C-0081)

(AD-A099189; TR-0081(6940-01)-5; SD-TR-81-29) Avail: NTIS HC A02/MF A01 CSCL 20/5

Laser modeling calculations have been performed for a helium-free DF laser operating on solid-grain reactants. The laser calculations include deactivation kinetics for BF3 that are based on measurements at 295 K. Reasonable estimates have been made for the scaling of the deactivation rates to higher vibrational levels and for the temperature dependence. The calculations show that the BF3 degrades the laser performance about 4% because of the deactivation kinetics. Author (GRA)

N81-26444# Army Missile Command, Redstone Arsenal, Ala. Research Directorate.

SOME LASER PHOTOCHEMICAL REACTIONS OF NITROGEN-CONTAINING COMPOUNDS WITH ETHYLENES

V. F. Kalasinsky, L. C. Warren, and J. A. Merritt 1 Oct. 1980 27 p refs

(AD-A099323; AD-E950118; DRSMI/RR-81-1-TR) Avail: NTIS HC A03/MF A01 CSCL 07/5

Some laser-induced reactions of tetrafluorohydrazine (N2F4) or nitrogen trifluoride (NF3) with 1,2-difluoroethylene (C2H2F2) or ethylene (C2H4) have been studied. Multiphoton absorption of infrared radiation from a CW CO2 laser initiates each of these reactions, and the major products have been identified as hydrogen fluoride (HF), CF4, CF3CN, CF3H, C2F4, and C2F6. The visible emission which accompanies the reactions has been shown to be due, in part, to transient C2 and CN. Possible mechanisms for these reactions are discussed. A reaction between ammonia (NH3) and C2H2F2 has also been studied and it probably proceeds through a non-equilibrium thermal process rather than by multiphoton dissociation as in the other cases. The main products have been identified as acetylene (C2H2) and hydrogen cyanide (HCN). The role of infrared laser-induced chemistry in general as a viable alternative to pyrolytic reactions is also discussed.

Author (GRA)

N81-26445# California Univ., Livermore. Lawrence Livermore Lab.

MANAGEMENT OF SHIVA OPTICS

F. T. Marchi and E. P. Wallerstein Sep. 1980 16 p Presented at the Huntsville Electro-Optical Technical Symp., Huntsville, Ala., 29 Sep. 1980

(Contract W-7405-eng-48)

(UCRL-84992; CONF-800982-2) Avail: NTIS HC A02/MF A01

In the design and procurement of a high power laser system such as the shiva fusion laser, the optical components are the single most important aspect for optimum laser performance. The cost, schedule and quality of the optics are the driving parameters for the entire program and many factors are involved in controlling, monitoring and evaluating these parameters. These factors include: (1) the procurement cycle; (2) knowledge of the vendors; (3) realistic specifications; (4) understanding of the fabrication process; (5) the quality control and test requirements. Guidelines and examples of the methods used in the procurement and qualification of the optics in shiva are presented. DOE

N81-26446# California Univ., Livermore. Lawrence Livermore Lab. Optical Coating Lab.
EVALUATION OF BICHROMATIC COATINGS DESIGNED FOR PULSED LASER FUSION APPLICATIONS AT 0.53 AND 1.06 MICROMETERS
G. R. Wirtenson, J. B. Willis, and E. A. Enemark Sep. 1980 14 p ref Presented at the Ann. Symp. on Optical Mater. for High Power Lasers, Boulder, Colo., Sep. 1980
(Contract W-7405-eng-48)
(UCRL-85524; CONF-8009119-2) Avail: NTIS HC A02/MF A01

Various bichromatic coatings designed to operate at both 0.53 and 1.06 micrometers were evaluated for spectral performance and laser damage threshold to determine the suitability of these coatings for 1 nanosecond pulse laser fusion experiments and to establish baseline data. Antireflection, partially transmitting high reflection, and maximum reflection coatings, consisting of titania and silica layers, were deposited onto BK-7 substrates. For each type of coating, two different designs were examined. Spectral measurements indicate the coatings met performance goals. Laser damage threshold values at 1.06 micrometers were similar to those of previous monochromatic production coatings, while damage levels at 0.53 micrometers were about one half these 1.06 micrometer values. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-26447* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CIRCUMFERENTIAL SHAFT SEAL Patent
Lawrence P. Ludwig, inventor (to NASA) Issued 12 May 1981 4 p Filed 7 Dec. 1979 Supersedes N80-18401 (18 - 09, p 1145) Division of US Patent Appl. SN-672219, filed 21 Mar. 1976, US-Patent-4,212,477
(NASA-Case-LEW-12119-2; US-Patent-4,266,788; US-Patent-Appl-SN-102004; US-Patent-Class-277-193; US-Patent-Class-277-153; US-Patent-4,212,477; US-Patent-Appl-SN-672219) Avail: US Patent and Trademark Office CSCL 11A

A circumferential shaft seal comprising two sealing rings held to a rotating shaft by means of a surrounding elastomeric band is disclosed. The rings are segmented and are of a rigid sealing material such as carbon or a polyimide and graphite fiber composite.

Official Gazette of the U.S. Patent and Trademark Office

N81-26448 Cornell Univ., Ithaca, N. Y.
TRANSIENT ELASTOHYDRODYNAMIC LUBRICATION ANALYSIS BY FINITE ELEMENT METHODS Ph.D. Thesis
Chi-Fan Shu 1981 259 p
Avail: Univ. Microfilms Order No. 8110914

A general and practical method to solve the elastohydrodynamic lubrication problem is developed by use of finite element techniques. Hydrodynamic and elastic equations are discretized utilizing variational principles. These coupled equations are then solved simultaneously and integrated numerically for a transient solution. The load, tangential velocity, viscosity, and possibly other prescribed parameters can vary arbitarily if required. The general formulation procedure is applied specifically to normal motion problems with either two dimensional or three dimensional conditions. Applications include a parametric study for the design of artificial knee joints. Effects of parameters such as elastic moduli, bearing depths, lubricant viscosity, and loads on the pressure distributions, shear stress, and on the lubrication performance were investigated. Dissert. Abstr.

N81-26449 Washington Univ., Seattle.
ROTOR DYNAMIC INFLOW DERIVATIVES AND TIME CONSTANTS FROM VARIOUS INFLOW MODELS Ph.D. Thesis
Dale Marvin Pitt 1980 230 p
Avail: Univ. Microfilms Order No. 8111843

A linear, unsteady theory was developed that relates transient rotor loads (thrust, roll moment and pitch moment) to the overall transient response of the rotor induced flow field. The relationships were derived from an unsteady, actuator disc theory; and some were obtained in closed form. The theory was used to determine the effects of lift distribution and shaft angle of attack on the said relationships. Also, two different assumptions were used to validate the actuator disc theory for normal flight conditions. The results reveal both the strengths and weaknesses of previous formulations and reveal areas in which further study is needed. The most significant result is an analytic, three degree of freedom inflow model that is shown to be accurate for use in the dynamic analysis of rotors. Dissert. Abstr.

N81-26450 Pittsburg Univ., Pa.
COMPUTER-AIDED DESIGN OF PREFORMS FOR POWDER FORGING Ph.D. Thesis
Suresh Pillay 1980 156 p
Avail: Univ. Microfilms Order No. 8112700

An interactive computer aided design approach is proposed and developed to facilitate the design and evaluation of preforms. The design is accomplished in two phases. The first phase is the description of the part to be forged together with a schematic sub division of the part into regions. The second phase involves the specification of trial preform shapes for the part. The program evaluates the input shape for densification and nonaggravating metal flow. This is accomplished by recognizing characteristic deformation modes in the input shape, for which available design rules are programmed. By interactively manipulating the preform shape, a proper preform is obtained rapidly. The program determines the size and mass distribution required in the preform to achieve full densification. The present program is implemented for nonaxisymmetric parts with a reasonably complex geometry. The procedure developed was applied to a weapon component. Dissert. Abstr.

N81-26451 North Carolina State Univ., Raleigh.
A STUDY OF SOME ASPECTS OF METAL MACHINING USING THE FINITE-ELEMENT METHOD Ph.D. Thesis
Martin Ralph Lajczok 1980 242 p
Avail: Univ. Microfilms Order No. 8111041

An analytical and experimental investigation was conducted of the mechanical state of the surface region of copper workpieces machined under dry, unlubricated conditions. The finite element method was used in conjunction with a shear plane model of the cutting process to predict the effects of tool rake angle and depth of cut on (1) the complete distribution of residual strain (deformation) in the surface region; and (2) the complete distribution of residual stress in the surface region. The analytical predictions were compared with the results of independently conducted experiments and good agreement was found. Dissert. Abstr.

N81-26452# Council for Scientific and Industrial Research, Pretoria (South Africa).
MINI-SEMINARS ON MACHINING TECHNOLOGY
May 1980 74 p refs Proceedings of seminars held in Pretoria, 26 Jun. 1980, 6 Aug. 1980, 10 Sep. 1980, 15 Oct. 1980 and 6 Nov. 1980
(CSIR-TSD-0002/80; ISBN-0-7988-1774-1) Avail: NTIS HC A04/MF A01

The seminars focused on the improvement and selection of machine tools and the optimization of machining techniques. Metal cutting and metal grinding are discussed. Equipment specifications for cutters, lathes, drills, and grinding machines are presented. Comparisons of different cutting fluids are reported along with the development of test methods for cutting fluids. For individual titles, see N81-26453 through N81-26458.

N81-26453# Six Hundred Mfg. (Pty) Ltd. (South Africa).
THE DEVELOPMENT OF THE MODERN MACHINE TOOL
L. Webster *In* CSIR Mini-Seminars on Machining Technol. May 1980 6 p (For primary document see N81-26452 17-37)
Avail: NTIS HC A04/MF A01

Five major developments are discussed: cutting tools that stand up to heat and abrasion generated by the chip/tool interface; lubrications and cutting fluids to suit higher speeds of cutting; bearings to satisfy the need for closer tolerances and higher cutting speeds; transmission methods for individually driven

machines with a greater selection of speeds and feeds; and automatic feeding mechanisms to replace hand feeding. Two modern methods of machine tool design are discussed: the bedway design and the headstock design. T.M.

N81-26454# Council for Scientific and Industrial Research, Pretoria (South Africa). Technical Service Dept.
OPTIMISING MACHINING CONDITIONS
P. H. H. Trendler *In its* Mini-Seminars on Machining Technol. May 1980 20 p refs (For primary document see N81-26452 17-37)
Avail: NTIS HC A04/MF A01

With the ever increasing cost of production, as well as the shortage of skilled labor, more efforts are being made to optimize the many operations that make up the total manufacturing industry. The metal working industry, in particular, has been slow in its efforts to improve machining efficiency. An outline of practical considerations which must be satisfied before any attempt is made to optimize machining conditions is presented. To be considered are: the machine tool, work holding methods, dimensional accuracy of the work-piece, surface finish, material to be machined, materials handling, and cutting tools. T.M.

N81-26455# Ford Motor Co. (South Africa).
SELECTION AND EVALUATION OF CUTTING TOOLS
C. C. Shearer *In* CSIR Mini-Seminars on Machining Technol. May 1980 17 p (For primary document see N81-26452 17-37)
Avail: NTIS HC A04/MF A01

The manufacturer as a user of both machine tools and cutting tools is continuously seeking higher productivity through increased output at minimum cost. The knowledge of the capabilities of the equipment available together with modern cutting tool techniques are necessary to achieve the desired goals. Component design specifications and cutting tool geometries for specific materials are presented. T.M.

N81-26456# De Beers Industrial Diamond Div. (Pty) Ltd. (South Africa).
GRINDING WITH AMBER BORON NITRIDE
P. N. Tomlinson and A. T. Notter *In* CSIR Mini-Seminars on Machining Technol. May 1980 9 p refs (For primary document see N81-26452 17-37)
Avail: NTIS HC A04/MF A01

The grinding performance superiority of ABN over conventional abrasives in both wet and dry grinding of high speed steel is shown. The high grinding radios for ABN are nearly always accompanied by cooler cutting conditions, less power and lower tensile stresses in the workpiece material than with conventional abrasives. The two basic types of Amber Boron Nitride, ABN300 and ABN360 are described. T.M.

N81-26457# AECI Ltd., Johannesburg (South Africa).
EXPERIENCE WITH THE USE OF INDEXABLE TIPS
A. E. H. Caldwell *In* CSIR Mini-Seminars on Machining Technol. May 1980 12 p (For primary document see N81-26452 17-37)
Avail: NTIS HC A04/MF A01

A turning test was conducted to compare brazed tip with indexable insert tools. Results indicate better cutting times and surface finish improvement. Tool costs are the same for each method but the indexable tips provide for safer chip removal. An analysis of estimates for jobs to be machined on center lathes is presented. T.M.

N81-26458# Council for Scientific and Industrial Research, Pretoria (South Africa). Technical Services Dept.
COMPARATIVE PERFORMANCE OF VARIOUS CUTTING FLUIDS
P. H. H. Trendler *In its* Mini-Seminars on Machining Technol. May 1980 12 p (For primary document see N81-26452 17-37)
Avail: NTIS HC A04/MF A01

A cutting fluid performs one or more of the following functions: cooling the tool, work piece and chip; lubricating (reduction of friction); minimizing build-up of the cutting tool edge; flushing away chips; and protecting the work piece from corrosion. Two methods of comparison were developed and used to compare six cutting fluids; drill wear measurement and the measurement of the wear of a single point milling cutter. T.M.

N81-26459*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SURFACE GEOMETRY OF CIRCULAR CUT SPIRAL BEVEL GEARS
R. L. Huston (Cincinnati Univ.) and John J. Coy 1981 23 p refs Presented at the NASA-AVRADCOM Symp. on Advan. Power Transmission Technol., Cleveland, 9-11 Jun. 1981 and proposed for presentation at the Design Eng. Tech. Conf., Hartford, Conn., 20-23 Sep. 1981; sponsored by the American Society of Mechanical Engineers
(Grant NsG-3188)
(NASA-TM-82622; E-873; AVRADCOM-TR-81-C-13) Avail: NTIS HC A02/MF A01 CSCL 13I

The tooth surface principal radii of curvature of crown (flat) gears were determined. Specific results are presented for involute, straight, and hyperbolic cutter profiles. It is shown that the geometry of circular cut spiral bevel gears is somewhat simpler than a theoretical logarithmic spiral bevel gear. A.R.H.

N81-26460*# Rocketdyne, Canoga Park, Calif.
HIGH-PRESSURE HOT-GAS SELF-ACTING FLOATING RING SHAFT SEAL FOR LIQUID ROCKET TURBOPUMPS Final Report, Mar. 1975 - Sep. 1980
R. E. Burcham and W. A. Diamond Sep. 1980 251 p refs (Contract NAS3-19425)
(NASA-CR-165392; RI/RD80-186) Avail: NTIS HC A08/MF A01 CSCL 11A

Design analysis, detail design, fabrication, and experimental evaluation was performed on two self acting floating ring shaft seals for a rocket engine turbopump high pressure 24132500 n/sq m (3500 psig) hot gas 533 K 9500 F) high speed 3142 rad/sec (30000 rmp) turbine. The initial design used Rayleigh step hydrodynamic lift pads to assist in centering the seal ring with minimum rubbing contact. The final design used a convergent tapered bore to provide hydrostatic centering force. The Rayleigh step design was tested for 107 starts and 4.52 hours total. The leakage was satisfactory; however, the design was not acceptable due to excessive wear caused by inadequate centering force and failure of the sealing dam caused by erosion damage. The tapered bore design was tested for 370 starts and 15.93 hours total. Satisfactory performance for the required life of 7.5 hours per seal was successfully demonstrated. Author

N81-26461*# Mechanical Technology, Inc., Latham, N. Y.
MECHANICAL DESIGN HANDBOOK FOR ELASTOMERS Final Report
M. Darlow and E. Zorzi Washington NASA Jun. 1981 354 p refs
(Contract NAS3-21623)
(NASA-CR-3423; MTI-81TR5) Avail: NTIS HC A16/MF A01 CSCL 13I

A comprehensive guide for the design of elastomer dampers for application in rotating machinery is presented. Theoretical discussions, a step by step procedure for the design of elastomer dampers, and detailed examples of actual elastomer damper applications are included. Dynamic and general physical properties of elastomers are discussed along with measurement techniques. M.G.

N81-26462# Northwestern Univ., Evanston, Ill. Technological Inst.
THERMOELASTIC EFFECTS IN SLIDING SYSTEMS Final Report, Sep. 1978 - Jun. 1980
A. L. Kistler 20 Apr. 1981 34 p refs
(Contract N00014-75-C-0761)
(AD-A099164) Avail: NTIS HC A03/MF A01 CSCL 20/11

The Northwestern high speed rubbing apparatus has been modified to remove certain ambiguities in output data interpretation. Some experiments have been carried out with the modified apparatus, and data on friction, temperature, and contact resistance have been obtained for a graphite-steel contact region. No thermoelastic instability effects were observed over a speed range of 70 M/sec. Author (GRA)

N81-26463# Southwest Research Inst., San Antonio, Tex.
MULTI-CYLINDER DIESEL ENGINE TESTS WITH UNSTABILIZED WATER-IN-FUEL EMULSIONS Final Report, Sep. 1978 - Jul. 1980

C. W. Coon, Jr. Mar. 1981 117 p refs
(Contract DOT-TSC-1587)
(AD-A098810; USCG-D-27-80; TSC-USCG-80-7) Avail: NTIS HC A06/MF A01 CSCL 21/5

Two diesel engines representative of the four-stroke cycle and two-stroke cycle main propulsion units installed in U.S. Coast Guard WPB class cutters were operated in a test environment in an attempt to demonstrate significant fuel savings associated with water-in-fuel emulsions. The engine were connected to a dynamometer in a laboratory test cell. A prototype fuel system was assembled that would supply unstabilized emulsions for which the water concentration could range from zero to 25 percent of the total volume of liquid supplied to the engine as fuel. An analysis of boat operation was performed in order to identify the most frequently used engine settings, and both engines were operated at test points representative of boat prop load performance. The test results for the four-stroke cycle engine indicated that an average diesel fuel saving of about 2.5 percent could be obtained at the most frequently encountered operating using water cocentrations of 15-25 percent. Statistical analysis procedures suggest a 90 percent confidence in the measured results. Significant reductions in exhaust smoke were also observed, although the exhaust stream opacity was low throughout the tests. For the two-stroke cycle engine, no statistically significant reduction in fuel consumption could be identified. Measurements of gaseous exhaust emissions were obtained for both engines; in general, the emissions increased with the presence of water in the fuel. GRA

N81-26464# Energy Research Associates, Oakland, Calif.
CONTINUOUS-BAND NITINOL HEAT ENGINE Final Report
A. David Johnson Sep. 1980 30 p refs
(Contract DE-FG03-78SF-01982; Grant EM-78-G-03-1982)
(DOE/SF-01982/T1) Avail: NTIS HC A03/MF A01

The development of a nitinol heat engine which utilizes the shape-memory properties of the alloy to convert heat to mechanical energy is discussed. A fully instrumented training engine was developed for preconditioning the wires to be used in the multiple band engine. A specialized wire rolling mill was built with which a few continuous loops were fabricated starting with annular rings cut from nitinol plate. Apparatus for measuring the stress strain temperature characteristics of naive and trained nitinol wire was modified to accommodate continuous loops. Torque versus speed curves were measured on the single wire engine. Internal forces and torques were recorded as naive wires were trained. In conjunction with state surface measurements (stress, strain, temperature cycles), these measurements reveal how the wires adapt to certain conditions so that power output may increase or decrease as the condition of the nitinol wire changes due to cycling, and thus change their match to the engine design. Fatigue experiments were run on several wires. The performance of a multiple band nitinol engine is documented. DOE

N81-26465# Radian Corp., Austin, Tex.
COMPARISON OF RELATIVE EMISSIONS FROM DOUBLE MECHANICAL PUMP SEALS TO OTHER TYPES OF PUMP SHAFT SEALS Final Report
L. P. Provost, J. E. Tobias, and S. L. Preston Feb. 1981 15 p refs
(Contract EPA-68-02-3171)
(PB81-162083; RAD-80-203-001-21-01; EPA-600/7-81-019; IERL-RTP-1137) Avail: NTIS HC A02/MF A01 CSCL 13B

Results of a comparison of pump seal data from nine petroleum refineries, to evaluate emissions from double mechanical pump seals versus those from other types of pump shaft seals are presented. Light and heavy liquid service seals were compared separately. Nonmethane leak rates for single and double seals were compared using schematic plots. Centrifugal/mechanical pump, centrifugal/packed pump, and reciprocal/packed pump leak rates were also compared using schematic plots. The percentages of seals leaking and 95 percent confidence intervals about the percentage leaking were calculated to evaluate the tendency for pump shaft seals to leak. In a cases, the confidence intervals for the invervals for the three types of pumps overlapped, indicating no significant difference between pump types for either single or double seals and light or heavy liquid service.

N81-26466# Corporate-Tech Planning, Inc., Waltham, Mass.
POTENTIAL OF SPARK IGNITION ENGINE FOR INCREASED FUEL EFFICIENCY Final Report, Jan. - Oct. 1978
Theodore Taylor, Jr., David Cole, and Jay A. Bolt Oct. 1980 89 p
(Contract DOT-HS-7-01789)
(PB81-158875; DOT-HS-805717) Avail: NTIS HC A05/MF A01 CSCL 21G

The potential of the spark ignition engine to deliver maximum fuel efficiency was assessed. Based on the results of an extensive literature search, manufacturer's known product plans, and fuel economies of 1978 engines as a baseline, proposed methods of attaining fuel economy while complying with future standards were ascertained. Methods of engine control optimization, engine design optimization as well as methods of varying engine parameters were considered. The potential improvements in fuel economy associated with these methods, singly and in combination, were determined and are expressed as percentage changes of the fuel economy of the baseline engines. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-26467*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LOGIC ANALYSIS OF COMPLEX SYSTEMS BY CHARACTERIZING FAILURE PHENOMENA TO ACHIEVE DIAGNOSIS AND FAULT-ISOLATION
James T. Wong and William L. Andre Apr. 1981 22 p refs Presented at the Joint Intern. Meeting of CORS and ORSA, Toronto, 3-6 May 1981 Prepared in cooperation with Army Research and Technology Labs., Moffett Field, Calif.
(NASA-TM-81291; USAAVRADCOM-TR-81-A-12; A-8561) Avail: NTIS HC A02/MF A01 CSCL 14D

A recent result shows that, for a certain class of systems, the interdependency among the elements of such a system together with the elements constitutes a mathematical structure a partially ordered set. It is called a loop free logic model of the system. On the basis of an intrinsic property of the mathematical structure, a characterization of system component failure in terms of maximal subsets of bad test signals of the system was obtained. Also, as a consequence, information concerning the total number of failure components in the system was deduced. Detailed examples are given to show how to restructure real systems containing loops into loop free models for which the result is applicable. Author

N81-26468# Auburn Univ., Ala. Dept. of Mechanical Engineering.
A STOCHASTIC MODEL OF RELIABILITY GROWTH Final Technical Report, 21 Mar. - 31 Dec. 1979
Darrell D. Penrod 18 Feb. 1980 37 p ref Revised
(Contract DAAK40-79-M-0103)
(AD-A096508; DRSMI/QR-80-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

A stochastic reliability growth model is developed for one-shot devices which assumes reliability improvement occurs only after failures occur and the amount of improvement is proportional to the unreliability. The basic model is given by P(sub k + 1) = P sub k + C(1 - P sub k) where P sub k is the reliability at the kth failure and C is a learning constant. Given an initial reliability P sub 0 and the learning constant C, the expected reliability after n trials is calculated by Markov chain methods. Combining a discrete prior distribution of the initial reliability and learning constant with test data using Bayes Theorem, a posterior distribution is developed which then is used to calculate the expected reliability growth curve. The model was applied to test data from three missile development programs. The results

compared favorably with the AMSAA model currently in use and showed more logical initial growth. The model does not appear to be unusually sensitive to priors or size of input matrices. GRA

N81-26469# Ship Structure Committee, Washington, D. C.
SUMMARY OF NONDESTRUCTIVE INSPECTION STANDARDS FOR HEAVY SECTION CASTINGS, FORGINGS AND WELDMENTS Final Report
Robert A. Youshaw Dec. 1980 28 p
(AD-A099119; SSC-300) Avail: NTIS HC A03/MF A01 CSCL 14/2

Code bodies, notably ASTM, have produced procedural guides, standard methods, and recommended practices which can be used to assure proper inspection for the various methods of nondestructive testing. These guides and practices in private industry have been reviewed for their applicability to quality control of heavy steel castings, forgings, and weldments. Acceptance criteria are not set forth, and recommendations are not suggested. They do, however, define levels of quality and describe the parameters generally agreed to be of significance which should be a part of the contractural agreement. The user must quantify these parameters according to service requirements and other considerations. Author (GRA)

N81-26470# Stanford Univ., Calif.
ACOUSTIC MICROSCOPY FOR NONDESTRUCTIVE EVALUATION OF MATERIALS Semiannual Technical Report, 1 Aug. 1980 - 31 Jan. 1981
C. F. Quate Mar. 1981 103 p refs
(Contract F49620-78-C-0098; ARPA Order 3569; AF Proj. 2306)
(AD-A098804; AFOSR-81-0435TR; GL-3232) Avail: NTIS HC A08/MF A01 CSCL 17/1

Our work consisted of further improvements in the acoustic microscope. We have extended the operation to higher frequencies (3.6 GHz with a wavelength of 0.4 micrometers). We have built new hardware and developed new software to enable us to record the image in digital form on floppy discs. We have devised a system for recording two simultaneous images, each with a different frequency. The difference frequency can be varied as we wish. We have done further work on materials - both Inconel and manganese ferrite. Author (GRA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-26471 Brown Univ., Providence, R. I.
CREEP OF 304 STAINLESS STEEL UNDER VARIABLE STRESSES OF COMBINED TENSION AND TORSION Ph.D. Thesis
Uee Wan Cho 1980 113 p
Avail: Univ. Microfilms Order No. 8111082

The creep behavior of 304 stainless steel at 593 C for pure tension, pure torsion, and combined tension and torsion under varying stress history was investigated. Creep experiments under step changes in stress included complete unloading, reloading, step up, step down, side steps and stress reversals of torsion with and without tension. The strain in the constitutive equations consists of five components: linear elastic, time independent plastic, time dependent recoverable viscoelastic, time dependent nonrecoverable viscous positive and time dependent nonrecoverable viscous negative components. For variable stressing the modified superposition principle, derived from the multiple integral representation, and strain hardening theory were used to represent the recoverable and nonrecoverable components, respectively, of the time dependent strain in the constitutive equations. Agreement was obtained between the experimental creep data for variable stress and predictions based on the information from constant stress test results, using the constitutive equation which combined all the above features. Dissert. Abstr.

N81-26472 Pennsylvania State Univ., University Park.
STRUCTURAL SYNTHESIS WITH STRESS, DISPLACEMENT AND BUCKLING CONSTRAINTS Ph.D. Thesis
Ganta Buchi Reddy 1980 155 p
Avail: Univ. Microfilms Order No. 8105792

A design algorithm is presented for synthesis of large structures under static loading. The objective of the synthesis is to obtain a minimum weight design within a reasonable time of computation. The behavioral constraints included in the algorithm are upper bounds on stresses and displacements, and lower bounds on buckling loads. An exact optimality criterion was utilized in the threatment of displacement and buckling constraints, whereas the fully-stressed design concept was employed for stress constraints. When stress constraints are present simultaneously with displacement or buckling constraints, the stress-constrained design is carried out first, and the resulting design variabls are then used as the minimum size constraints for diplacements or buckling loads. Two finite element computer codes capable of synthesizing structures with linear or non-linear size-stiffness relations were developed aruound the design algorithm.
Dissert. Abstr.

N81-26473 Arizona Univ., Tucson.
AN IMPROVED METHOD FOR WIND-TUNNEL WALL-CORRECTIONS DEDUCED BY ITERATING FROM MEASURED WALL STATIC-PRESSURE Ph.D. Thesis
Dale Francis Moses 1981 308 p
Avail: Univ. Microfilms Order No. 8112853

The viability of a method, for obtaining wind-tunnel wall-corrections from measurements of near-field flow parameters by an interative procedure is demonstrated. A case is made for the improved accuracy of this method over the standard method of images. The wall-correction method was applied to an actual wind-tunnel test of a slightly oversized wing model at low subsonic speeds. The wind tunnel facility and experimental setup and method are described and discussed. The procedure for the iterations is described and the criterion for convergence to unconfined flow is presented. Test cases consisting of known, simple flows are used to verify the computational methods. Finally, the wall correction to the lift curve of the wing model is presented as well as the correction at a typical tail position and the correction to the induced drag of the wing. Dissert. Abstr.

N81-26474 Cornell Univ., Ithaca, N. Y.
AUTOMATIC TWO-DIMENSIONAL QUASI-STATIC AND FATIGUE CRACK PROPAGATION USING THE BOUNDARY ELEMENT METHOD Ph.D. Thesis
George Elbert Blandford 1980 296 p
Avail: Univ. Microfilms Order No. 8110970

A boundary element code was developed which automatically generates the modified data required to perform two dimensional linear elastic quasi-static and fatigue crack propagation. The numerical implementation of the boundary integral equation, referred to as the boundary element method, uses isoparametric linear and/or quadratic polynomial approximation of the boundary geometry, displacements and tractions. Gaussian quadrature is used to evaluate the discretized boundary integrals. Because of the singularities which exist in the boundary integrals, special singularity factorization schemes are presented so that the singular integrals can be evaluated accurately. A multidomain boundary element formulation is also presented. Several example problems are presented verifying the accuracy, efficiency and flexibility of the present boundary element method implementation.
Dissert. Abstr.

N81-26475 Cornell Univ., Ithaca, N. Y.
AN EXPERIMENTAL INVESTIGATION OF TRANSIENT DEFORMATION BASED ON A STATE VARIABLE APPROACH Ph.D. Thesis
Panteleimon Sophoclis Alexopoulos 1981 204 p
Avail: Univ. Microfilms Order No. 8110994

A state variable phenomenological model was used as a basis to investigate nonelastic deformation in polycrystalline solids at room temperature. This model was developed with special attention given to the description of transient deformation phenomena such as anelasticity, microplasticity and the Bauschinger effect. A combination of load relaxation and constant displacement test was used to determine the material parameters

and flow equations required by the phenomenological model. The materials investigated included commercial purity aluminum and type 316 stainless steel. Load relaxation data on microplasticity suggest that it is governed by flow equations that exhibit a master curve type of behavior, in a plot of logarithmic stress versus logarithmic nonelastic strain rate covering a wide range of strain rates at a given temperature and microstructural state of a material. At low homologous temperatures and/or high stresses, microplasticity was found to be controlled by dislocation glide and at high homologous temperatures and/or low stresses microplasticity is controlled by dislocation climb. Dissert. Abstr.

N81-26476 Cornell Univ., Ithaca, N. Y.
INTERACTIVE FINITE ELEMENT ANALYSIS OF REINFORCED CONCRETE: A FRACTURE MECHANICS APPROACH Ph.D. Thesis
Victor Edouard Saouma 1981 256 p
Avail: Univ. Microfilms Order No. 8110990

Problems associated with interelement cracks nucleation and propagation are solved using an interactive computer code. The main advantage of this approach is its ability to properly model the stress singularity at the tip of a crack, and use fracture mechanics criteria for the stability and the length of the crack extension. The computer program developed is capable of automatically simulating discrete crack nucleation and extension through a finite element mesh as governed by an appropriate analysis. The user can interact with the program through a storage tube graphics display device. A parametric study of a reinforced concrete beam was performed. The effects of fracture toughness, aggregate interlock and concrete nonlinearity were assessed. Dissert. Abstr.

N81-26477 Kansas Univ., Lawrence.
SHEAR STRENGTH OF LIGHTLY REINFORCED CONCRETE BEAMS Ph.D. Thesis
Michael N. Palaskas 1980 207 p
Avail: Univ. Microfilms Order No. 8111790

Fifteen lightly reinforced concrete T-beams, eleven with stirrups and four without stirrups, were tested to failure. The major variables in the study were the amounts of flexural and shear reinforcement. The flexural steel varied from one-half to one percent, and the shear reinforcement varied from zero to about 110 psi. The analysis of the test results indicates that lightly reinforced concrete T-beams exhibit a reduction in shear capacity when compared to similar beams with normal to large percentages of longitudinal reinforcement. An analytical model is developed which examines the effects of concrete strength, shear-span to depth ratio, percentage of flexural steel and amount of shear reinforcement on the shear capacity of normal reinforced concrete beams. Dissert. Abstr.

N81-26478 Brown Univ., Providence, R. I.
PLANE WAVE EXPERIMENTS IN DYNAMIC PLASTICITY Ph.D. Thesis
Kyung-Suk Kim 1980 128 p
Avail: Univ. Microfilms Order No. 8111124

Macroscopic and microscopic aspects of dynamic plasticity are studied experimentally with plane plastic waves generated by plate impact. For the macroscopic study, oblique plate impact experiments were carried out for 6061-T6 aluminum. A transverse displacement interferometer (TDI) was developed for the measurement of transverse wave profiles. For the microscopic observations, dislocation dynamics in MgO single crystals was studied by means of plate impact experiments in which specimens were subjected to stress pulses with durations in the range of 90-230 ns. Particle velocity time profiles were measured with a laser displacement interferometer and compared with predictions of elastic analysis. Experiments with different thermal histories showed that inclusions play a role in the generation of interior glide bands. An experiment with a very short duration pulse (86 ns) suggests the existence of a threshold time for the formation of interior glide bands. Dissert. Abstr.

N81-26479 California Inst. of Tech., Pasadena.
VORTEX-INDUCED VIBRATIONS OF STRUCTURES Ph.D. Thesis
Shawn Anthony Hall 1981 224 p
Avail: Univ. Microfilms Order No. 8111494

Three prototype problems are studied; including harmonically forced cylinders, spring mounted cylinders, and taut elastic cables; in each case the structure is assumed to be of circular cross-section and situated in a uniform cross flow. Only oscillations transverse to the flow are considered. The problem of modal interaction for elastic cables, typically of interest when the fluid flow excites high mode number resonances, is given particular attention. The model produces a set of nonlinear, ordinary differential equations describing the coupled fluid/structure oscillations. Steady state oscillatory solutions to these equations are found analytically and are examined for stability. Using various regression techniques, the steady-state solutions are then fit to experimental data for forced and spring-mounted cylinders. Finally, the model's predictions for elastic cables are used to postulate a qualitative picture of model interaction, certain features of which have been observed experimentally. Dissert. Abstr.

N81-26480 Boston Univ., Mass.
FINITE ELEMENT ANALYSIS OF AXISYMMETRIC RUBBER MEMBRANES Ph.D. Thesis
Arthur Richard Johnson, III 1981 109 p
Avail: Univ. Microfilms Order No. 8112208

The nonlinear deformations of axisymmetric membranes made of Mooney material are determined using the finite element method. The analysis is presented in a form that can be extended to other non-quadratic energy functionals. A one-dimensional axisymmetric form of the potential energy is used. The potential energy's element gradient and Hessian matrices are computed. These element gradient and Hessian matrices are expressed as a sum of coefficients, that depend nonlinearly on the element nodal displacements, times a set of matrices, that depend on the finite element interpolation functions. Numerical integration is used to obtain the element matrices which contrain rational expressions of the nodal unknowns. The axisymmetric deformations analyzed are the in-plane expansion of a disk with a hole, the inflation of an initially flat disk, the out-of-plane deformation of a disk with a circular rigid inclusion, the inflation of a torus with both circular and elliptical undeformed cross sections, and the stretching and inflation of a circular cylinder. Dissert. Abstr.

N81-26481 Wayne State Univ., Detroit, Mich.
ROD THEORY DERIVED FROM ORIENTED OR DIRECTED CURVES Ph.D. Thesis
Heng-Yee Chen 1980 121 p
Avail: Univ. Microfilms Order No. 8107198

An oriented or directed curve is, mathematically, two sets of vector fields. By applying the postulates of classical continuum mechanics to these fields, a complete theory of motion can be deduced, including, for example, strain and stress measures and constitutive equations. A rod belongs to the set of oriented curves. One vector field (a set of one) defines the curve of centroids of the cross section which is itself specified by two vector fields (from the second set of three vectors). By exploiting this definition with regard to an elastic three-dimensional body, the linearized theory is developed for a first perturbation about a nonlinearly deformed configuration of a rod constrained to have an area preserving cross section. This generalization further clarifies quantities which appear in the mathematical theory of oriented curves. For example, a physical interpretation of a stress measure is possible in terms of the classical Cauchy stress and of a generalized oriented vector density in terms of moments of the cross section. Finally, the nonlinear equations of plane motion are used to study the dynamic response of rods subjected to impact loads. Dissert. Abstr.

N81-26482 Wisconsin Univ. - Madison.
AN EXPERIMENTAL APPROACH TO FATIGUE UNDER RANDOM VIBRATIONS Ph.D. Thesis
Vinod Kumar Nagpal 1980 308 p
Avail: Univ. Microfilms Order No. 8106518

A batch of 24 specimens in the elastic range and 24 specimens in the elastic-plastic range were tested in order to study the effects of 8 probabilistic parameters in the elastic range and 11 in the elastic-plastic range. The response signal of every tested specimen was digitized and recorded on magnetic tapes. Time series models were fitted to the response signal of every specimen from which spectrum and spectral moments were computed. The magnitude levels of all the probabilistic parameters

were computed from the spectral moments of each response. An average deviation of the predicted life by the test model from the actual life was obtained to 8.32 percent on the negative side and 6.35 percent on the positive side for the elastic range. Similarly an average deviaton of 5.50 percent on the negative side and 7.0 percent on the positive side were obtained in the elastic-plastic range. Dissert. Abstr.

N81-26483 Cornell Univ., Ithaca, N. Y.
A PHENOMENOLOGICAL THEORY FOR ELASTIC FLUIDS Ph.D. Thesis
William Ehrat VanArsdale 1981 87 p
Avail: Univ. Microfilms Order No. 8110891

Consideration of the microstructure in polymeric liquids suggests a constitutive theory of the state variable type for these fluids. A symmetric, tensor variable is used to characterize polymer deformation. A mechanical theory for an incompressible fluid is proposed in which the extra-stress is composed of an elastic part, that depends only on the tensor variable and a purely viscous part. The elastic stress is determined in terms of a free energy function and a particularly simple expression for the slippage tensor is chosen. The resulting theory for elastic fluids linearizes to the corotational Jefferys model. A simple form of this theory seems to accurately describe polymer solutions. This involves four material constants which are determined from viscosity and primary normal stress coefficient data in steady shear flow. Dissert. Abstr.

N81-26484 Kansas Univ., Lawrence.
A STUDY OF CRACK GROWTH BEHAVIOR AND SPECIMEN SIZE EFFECTS IN THE CRACK (TIP) OPENING DISPLACEMENT TEST Ph.D. Thesis
Allan Bertram Stuber 1980 157 p
Avail: Univ. Microfilms Order No. 8111791

The crack growth behavior and specimen size effects in the Crack (tip) Opening Displacement (C(T)OD) Test were studied. A pressure vessel steel was used as the test material. Fractographic examination of several fracture surfaces showed that the slow crack growth region was also apparent on speciments that were not heat tinted. Slow crack growth occurs if the ratio of the inelastic displacement to the total displacement is greater than 0.8. The dependence of the C(T)OD values on test specimen geometry was examined. The C(T)OD values were determined throughout the transition temperature region for six particular test specimen geometries. A nonlinear finite element analysis procedure was used to model the test specimens for particular loading conditions. Three dimensonal nonlinear and two dimensional plane strain conditions were examined. The 3-D model provided a more accurate prediction of the experimental test results than the 2-D model. Dissert. Abstr.

N81-26485 Cornell Univ., Ithaca, N. Y.
AN INTEGRATED SYSTEM FOR FINITE ELEMENT SHELL ANALYSIS-SURFACE REPRESENTATION AND CURVED SHELL ELEMENT Ph.D. Thesis
Sheng-Chuan Wu 1981 235 p
Avail: Univ. Microfilms Order No. 8111000

In an effort to resolve problems occurring in the finite element analysis of general shells, a surface representation system and a triangular, thin shell finite element were developed. The system is a synthesis of spline theory and algorithms, and an interactive means for man-machine communication. The basic technique employed is a modified lofting method in which sectional curves are represented by uniform cubic B-splines and the surface is interpolated through these sections by cardinal splines. In conjunction with the application of this surface representation system, an efficient, triangular, doubly-curved thin-shell element was developed. The formulation is based on the displacement method, and has 36 degrees of freedom per element. The motivation was to establish an element that is computationally efficient, yet general enough to deal with any practical shell structure. Dissert. Abstr.

N81-26486 Cornell Univ., Ithaca, N. Y.
LOCAL BOND BETWEEN A STEEL BAR AND CONCRETE UNDER HIGH INTENSITY CYCLIC LOAD Ph.D. Thesis
Siripong Hungspreug 1981 477 p
Avail: Univ. Microfilms Order No. 8110979

The local bond behavior of single, double, and triple-ribbed reinforcing bars in concrete under high intensity cyclic load was studied with the goal of obtaining bond stiffness at various stages of loading to be used as input data for the finite element analysis. Fifty-four simple pullout tests were carried out with the main variables being loading history, confining pressure, number of ribs and direction of loading relative to direction of casting. Test results show that loading history with loading amplitude less than about half of the ultimate load does not affect the bond stiffness or the ultimate bond strength. However, the amount and the rate of increase of slip are higher for specimens under reversed-cyclic load than those repeated load. The confining pressure increases the ultimate bond strength and the ductility but the bond stiffness remains the same. Direction of loading relative to direction of casting is important only in the first cycle because the porous concrete is compacted upon the first loading cycle. Dissert. Abstr.

N81-26487 California Univ., Los Angeles.
ELASTIC-PLASTIC ANALYSIS OF STRUCTURES FOR SMALL AND LARGE DISLACEMENT THEORY USING THE FINITE ELEMENT METHOD Ph.D. Thesis
Russell Howard England 1981 259 p
Avail: Univ. Microfilms Order No. 8111219

The finite element method as applied to nonlinear structural systems is reviewed with particular emphasis to numerical solution techniques. Numerical techniques that operate in a more efficient manner for a wider class of problems are developed. Two basic solution procedures to the elastic-plastic small displacement problem are reviewed: (1) the pseudo-plastic load method; and (2) the incremental tangent modulus method. With the pseudo-plastic load method, inelastic effects are evaluated through an iterative procedure (in essence a trial-and-error technique) wherein the effects of plastic strains on the system response are evaluated using a pseudo-plastic load and the elastic system stiffness. The incremental tangent modulus method, on the other hand, evaluates the nonlinear response through the accumulation of a series of piece-wise linear analyses. Improved methods are developed which alleviate previous inadequacies, and examples including truss, beam, and plane stress structures are presented to demonstrate the improved computational efficiency and problem versatility of these numerical methods. Dissert. Abstr.

N81-26488 Cornell Univ., Ithaca, N. Y.
AN INTEGRATED FINITE ELEMENT NONLINEAR SHELL ANALYSIS SYSTEM WITH INTERACTIVE COMPUTER GRAPHICS Ph.D. Thesis
San-Cheng Chang 1981 277 p
Avail: Univ. Microfilms Order No. 8110971

An analysis system integrating state-of-the-art interactive computer graphics technology with finite element shell analysis algorithm is developed. The system is verified by the solution of a number of benchmark problems, and its practical value is demonstrated by application to problems of industrial significance. Two subjects are investigated. The first is the reduction of human effort required for applying finite element analysis to shells of conventional and arbitrary geometries. The second is the development of the geometrically nonlinear aspects of a newly formulated doubly-curved triangular thin-shell element. Dissert. Abstr.

N81-26489 Wisconsin Univ. - Madison.
DYNAMIC RESPONSE OF FLUID FILLED CYLINDRICAL SHELLS TO THERMAL LOADS Ph.D. Thesis
Surendra Nath Singhal 1980 282 p
Avail: Univ. Microfilms Order No. 8106530

A perturbation technique is used to solve the problem of transient response of isotropic elastic, thin, fluid filled hemicyclindrical shells, with temperature dependent material properties. Modified Flugge's equations that include temperature dependent material properties are used. For a comparative study, the analysis is repeated using simplified Donnell's equations. The solution is formulated for a general temperature loading and a general temperature dependence of material properties for simply supported shells filled with compressible fluid. A small perturbation parameter defining the variation in the modulus of elasticity is used to reduce the shell equations with variable coefficients to those with constant coefficients for various powers of the

perturbation. Numerical examples are solved for temperature loadings independent of the circumferential and axial coordinates and material properties that are linear functions of temperature for shells filled with incompressible fluid, with all boundaries simply supported. Dissert. Abstr.

N81-26490 Brown Univ., Providence, R. I.
AN ANALYSIS OF LOCALIZED NECKING IN BIAXIALLY STRETCHED SHEETS Ph.D. Thesis
Chin-Chan Chu 1980 102 p
Avail: Univ. Microfilms Order No. 8111084

Localized necking of sheet metals subject to out of plane punch stretching is studied. Attention is directed to the effects of various constitutive laws on the development of a localized neck. An axisymmetric finite element analysis, within the framework of membrane theory, is carried out of the hemispherical punch stretching of a circular sheet. Three rate independent material models are considered, namely, classical plasticity theory with a smooth yield surface of von Mises kind, a deformation theory model of a solid with a vertex on its yield surface, and a plastically dilating constitutive relation with pressure dependent yielding, that models, approximately, ductile rupture on the microscale. Based on the numerical results, forming limit curves are determined for each of these constitutive models. In contrast to in plane stretching, the geometric effects of out of plane stretching makes the formation of a localized thickness trough possible, even if the classical plasticity theory is employed. For the deformation theory model, the out of plane forming limit curves are shown to coincide with those for in plane stretching. Dissert. Abstr.

N81-26491*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
FINITE-ELEMENT NONLINEAR TRANSIENT RESPONSE COMPUTER PROGRAMS PLATE 1 AND CIVM-PLATE 1 FOR THE ANALYSIS OF PANELS SUBJECTED TO IMPULSE OR IMPACT LOADS
Robert L. Spilker, Emmett A. Witmer, Susan E. French, and Jose J. A. Rodal Sep. 1980 497 p refs
(Grant NGR-22-009-339)
(NASA-CR-165215; ASRL-TR-154-14) Avail: NTIS HC A21/MF A01 CSCL 20K

Two computer programs are described for predicting the transient large deflection elastic viscoplastic responses of thin single layer, initially flat unstiffened or integrally stiffened, Kirchhoff-Lov ductile metal panels. The PLATE 1 program pertains to structural responses produced by prescribed externally applied transient loading or prescribed initial velocity distributions. The collision imparted velocity method PLATE 1 program concerns structural responses produced by impact of an idealized nondeformable fragment. Finite elements are used to represent the structure in both programs. Strain hardening and strain rate effects of initially isotropic material are considered. R.C.T.

N81-26492*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROELASTIC CHARACTERISTICS OF A CASCADE OF MISTUNED BLADES IN SUBSONIC AND SUPERSONIC FLOWS
Robert E. Kielb and Krishna Rao V. Kaza (Toledo Univ.) 1981 18 p refs Proposed for presentation at the 8th Biennial Eng. Div. Conf., Hartford, Conn., 20-23 Sep. 1981; sponsored by the American Society of Mechanical Engineers
(Grant NsG-3139)
(NASA-TM-82631; E-886) Avail: NTIS HC A02/MF A01 CSCL 20K

The effects of mistuning on flutter and forced response of a cascade in subsonic in subsonic and supersonic flow were investigated. The aerodynamic and structural coupling between the bending and torsional motions and the aerodynamic coupling between the blades were studied. It is shown that frequency mistuning always has a beneficial effect on flutter. For the cascade considered, the potential for raising flutter speed is greater in subsonic than in supersonic flow. Preliminary results for structural damping mistuning show that there are no additional benefits over adding damping mistuning may have either a beneficial or an adverse effect on forced response, depending on the engine order of the excitation and Mach number. A.R.H.

N81-26493*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.
EFFECTIVE CONSTITUTIVE RELATIONS FOR LARGE REPETITIVE FRAME-LIKE STRUCTURES Semiannual Progress Report, period ending 30 Apr. 1981
Adnan H. Nayfeh and Mohamed S. Hefzy 1981 33 p refs
(Grant NsG-1185)
(NASA-CR-164521) Avail: NTIS HC A03/MF A01 CSCL 20K

Effective mechanical properties for large repetitive framelike structures are derived using combinations of strength of material and orthogonal transformation techniques. Symmetry considerations are used in order to identify independent property constants. The actual values of these constants are constructed according to a building block format which is carried out in the three consecutive steps: (1) all basic planar lattices are identified; (2) effective continuum properties are derived for each of these planar basic grids using matrix structural analysis methods; and (3) orthogonal transformations are used to determine the contribution of each basic set to the overall effective continuum properties of the structure. S.F.

N81-26494*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OVERVIEW OF LANGLEY ACTIVITIES IN ACTIVE CONTROLS RESEARCH
I. Abel and J. R. Newsom Jun. 1981 21 p refs Presented at the Joint Automatic Control Conf., Charlottesville, Va., 18-19 Jun. 1981
(NASA-TM-83149) Avail: NTIS HC A02/MF A01 CSCL 20K

The application of active controls technology to reduce aeroelastic response of aircraft structures offers a potential for significant payoffs in terms of aerodynamic efficiency and weight savings. The activities of the Langley Research Center (LaRc) in advancing active controls technology. Activities are categorized into the development of appropriate analysis tools, control law synthesis methodology, and experimental investigations aimed at verifying both analysis and synthesis methodology. E.D.K.

N81-26495*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
APPLICATION OF CONSTRAINED OPTIMIZATION TO ACTIVE CONTROL OF AEROELASTIC RESPONSE
J. R. Newsom and V. Mukhopadhyay Jun. 1981 15 p refs Presented at the Joint Automatic Control Conf., Charlottesville, Va., 18-19 Jun. 1981
(NASA-TM-83150) Avail: NTIS HC A02/MF A01 CSCL 20K

Active control of aeroelastic response is a complex in which the designer usually tries to satisfy many criteria which are often conflicting. To further complicate the design problem, the state space equations describing this type of control problem are usually of high order, involving a large number of states to represent the flexible structure and unsteady aerodynamics. Control laws based on the standard Linear-Quadratic-Gaussian (LQG) method are of the same high order as the aeroelastic plant. To overcome this disadvantage of the LQG mode, an approach developed for designing low order optimal control laws which uses a nonlinear programming algorithm to search for the values of the control law variables that minimize a composite performance index, was extended to the constrained optimization problem. The method involves searching for the values of the control law variables that minimize a basic performance index while satisfying several inequality constraints that describe the design criteria. The method is applied to gust load alleviation of a drone aircraft. A.R.H.

N81-26496*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
QUALITATIVE COMPARISON OF CALCULATED TURBULENCE RESPONSES WITH WIND-TUNNEL MEASUREMENTS FOR A DC-10 DERIVATIVE WING WITH AN ACTIVE CONTROL SYSTEM
Boyd Perry, III Jun. 1981 13 p refs Presented at the AIAA Dyn. Specialist Conf., Atlanta, 8-11 Apr. 1981
(NASA-TM-83144; AIAA-81-0567) Avail: NTIS HC A02/MF A01 CSCL 20K

Comparisons are presented analytically predicted and

experimental turbulence responses of a wind tunnel model of a DC-10 derivative wing equipped with an active control system. The active control system was designed for the purpose of flutter suppression, but it had additional benefit of alleviating gust loads (wing bending moment) by about 25%. Comparisions of various wing responses are presented for variations in active control system parameters and tunnel speed. The analytical turbulence responses were obtained using DYLOFLEX, a computer program for dynamic loads analyses of flexible airplanes with active controls. In general, the analytical predictions agreed reasonably well with the experimental data. E.D.K.

N81-26497*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRUCTURES AND DYNAMICS DIVISION RESEARCH AND TECHNOLOGY PLANS, FISCAL YEAR, 1981
Kay S. Bales Jun. 1981 43 p refs
(NASA-TM-83137) Avail: NTIS HC A03/MF A01 CSCL 20K

The objectives, expected results, approach, and FY81 milestones for the Structures and Dynamics Division's research program are presented. This information will be useful in program coordination with other government organizations in areas of mutual interest. Author

N81-26498# Princeton Univ., N. J. Dept. of Civil Engineering.
ON THE NATURE OF BOUNDARY CONDITIONS FOR CRACK TIP STRESS
A. Cemal Eringen Apr. 1981 29 p refs
(Contract N00014-76-C-204; NR Proj. 064-410)
(AD-A098911; Rept-81-SM-6; TR-55) Avail: NTIS HC A03/MF A01 CSCL 20/11

Our recent calculations on crack tip stresses were scrutinized by Atkinson (1980), suggesting that our scheme of calculations is not uniform and the solution of the problem may not actually exist. Here we show that these difficulties arise because of the use of incorrect boundary conditions by Atkinson. Also, we give an exact solution of a problem which refutes the suggested inexistence. Author (GRA)

N81-26499# Dayton Univ., Ohio. Research Inst.
FATIGUE CRACK GROWTH RATE DATA ACQUISITION SYSTEM FOR LINEAR AND NONLINEAR FRACTURE MECHANICS APPLICATIONS Interim Technical Report, Sep. 1979 - Sep. 1980
John J. Ruschau Wright-Patterson AFB, Ohio AFWAL Mar. 1981 34 p refs
(Contract F33615-80-C-5011; AF Proj. 2421)
(AD-A099376; UDR-TR-80-83; AFWAL-TR-81-4011) Avail: NTIS HC A03/MF A01 CSCL 20/11

A computer based, automated data acquisition system was developed for determining fatigue crack growth rate data for both linear and nonlinear fracture mechanics testing. The system hardware employed an HP 9825A Desktop Computer equipped with an HP 6940B Multiprogrammer which digitized the analog test signals (load and displacement) for input to the computer. For linear elastic fracture mechanics (LEFM) testing the crack growth rate, da/dN, is presented as a function of the stress intensity factor range, Delta K. Compliance relationships are used to monitor crack length which is then used to calculate the stress intensity range. For nonlinear fracture mechanics (NLFM) testing, the crack growth rate is related to the rate of potential energy change, or Delta J. Compliance techniques are also employed to monitor crack extension. The results for both analysis methods obtained with the acquisition system are in excellent agreement with results obtained using the more conventional visual and analytical methods. GRA

N81-26500# Lincoln Lab., Mass. Inst., of Tech., Lexington.
OPTIMAL REGULATION OF STRUCTURAL SYSTEMS WITH UNCERTAIN PARAMETERS
David C. Hyland 2 Feb. 1981 149 p refs
(Contract F196628-80-C-0002)
(AD-A099111; TR-551; ESD-TR-80-246) Avail: NTIS HC A07/MF A01 CSCL 13/13

Difficulties arising from inherent inaccuracies in structural modelling and from the high dimensionality of the dynamical system force a re-examination of the problem of optimal control of large flexible structures within the context of stochastic system theory. This work specifically addresses the mean-square optimal control of a linear mechanical system with random open-loop modal frequencies. Recognizing that a complete probabilistic description of modal parameters can never be provided, we first identify the minimum set of a-priori data needed to preserve any measure of modelling fidelity. Acknowledging this data as available, a complete probability assignment is then induced by a maximum entropy principle. The resulting mean-square optimization problem is consequently reduced to the solution of a modified Riccati equation. Various properties of this equation are explored. In particular, it is shown that the proposed approach guarantees stochastic stability, directly produces inherently robust controls for highly uncertain systems and significantly reduces the burden of design computation.
Author (GRA)

N81-26501# Materials Research Labs., Ascot Vale (Australia).
INSTRUMENTATION OF NATIONAL PHYSICAL LABORATORY FATIGUE TESTING MACHINE
N. J. Baldwin, D. S. Saunders, and N. M. Burman Dec. 1980 13 p
(AD-A099293; MRL-TN-448; AR-002-387) Avail: NTIS HC A02/MF A01 CSCL 20/11

A National Physical Laboratory fatigue testing machine used for the fatigue pre-cracking of Charpy-sized test specimens has been instrumented. It is now possible to monitor crack growth electronically thereby reducing the operator's time in attendance at the machine from hours to minutes and improving the reproducibility of fatigue precracking. Author (GRA)

N81-26502# Battelle Pacific Northwest Labs., Richland, Wash.
A REVIEW OF ADVANCED ACOUSTIC EMISSION SENSORS Interim Report
D. K. Lemon Apr. 1981 136 p refs
(Contract N62269-80-C-0243; DARPA Order 3905)
(AD-A098989; Rept-23111-04210; NADC-81087-60) Avail: NTIS HC A07/MF A01 CSCL 17/1

This report describes work done to evaluate emerging, advanced sensors for detection of acoustic emission from fatigue crack growth. This task is part of an overall project whose objective is to develop acoustic emission monitoring of fatigue crack growth in aircraft. Section 1, the operation of each candidate sensor is summarized. Section 2 described the criteria used to evaluate the suitability of each sensor for near-term use on this acoustic emission project. Recommendations are provided regarding which sensor concepts appear to be most promising within the context of the project's needs. The appendices contain papers that were submitted to Battelle by various experts discussing the sensor concepts. GRA

N81-26503# SRI International Corp., Menlo Park, Calif.
FRACTURE OF STRUCTURAL MATERIALS UNDER DYNAMIC LOADING Final Technical Report, 2 Feb. 1977 - 1 Feb. 1981
Donald A. Shockey Washington AFOSR 25 Mar. 1981 39 p refs
(Contract F49620-77-C-0059; AF Proj. 2306; SRI Proj. PYU-6130)
(AD-A098791; AFOSR-81-0402TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

Classical concepts of Griffith-Irwin fracture mechanics were extended to include time effects and hence to apply to crack instability under dynamic loads. Theoretical considerations of the stress intensity histories experienced by cracks subjected to short pulse loads suggested that instability requires the crack tip stress intensity to exceed the dynamic toughness for a minimum time. This postulate was checked by experiments. Impact techniques were used to produce well-defined stress pulses in specimens of an epoxy, 4340 steel, 1018 steel, and 6061-T6 aluminum containing cracks of several lengths to observe crack instability behavior. The experimental results were not well described by static fracture mechanics, but were in accord with the minimum time postulates deduced from stress intensity histories. The understanding gained from the research program promises to be useful in assessing the safety of structures under dynamic loads, in characterizing the dynamic fracture resistance of

materials, and in designing equipment and procedures for measuring dynamic fracture toughness. The relationship between dynamic initiation toughness and dynamic propagation toughness was addressed. The temperature histories in material near a rapidly propagating crack in a steel plate were measured and used to compute the heat of fracture and the dynamic propagation toughness. Simultaneous measurements of the dynamic stress intensity were made using the shadow optical method of caustics and high speed photography. GRA

N81-26504# Forest Products Lab., Madison, Wis.
BENDING STRENGTH OF SHALLOW GLUED-LAMINATED BEAMS OF A UNIFORM GRADE
Catherine M. Marx and Russell C. Moody Apr. 1981 22 p refs
(AD-A099008; FSRP-FPL-380) Avail: NTIS HC A02/MF A01 CSCL 13/13

Bending tests of Douglas-fir and southern pine glulam beams of 2-, 4-, or 6-laminations revealed the following about the accuracy of the three methods for predicting near-minimum bending strengths: (1) The minimum strength ratio (SR) concept, method A, overestimated most of the near-minimum values; (2) No difference could be detected between the minimum SR concept, method B, and the K/G concept. These two methods also overestimated some of the near-minimum values. In addition, the data revealed no general trend of increase in the bending strength values from 2- to 4- to 6-laminations as both the K/G and method B concepts predict; and (3) A new prediction method was developed which suggests that better estimates of design bending strength values may be obtained by using the SR concept, method A, with an applied adjustment factor of 0.85. These results agree with the results of both J. W. Johnson and Fox, again suggesting that present prediction methods overestimate the strength of glulam beams without specially graded tension laminations. GRA

N81-26505# Hughes Research Labs., Malibu, Calif.
MECHANICAL STRESS IN THIN FILMS Final Technical Report
M. Pedinoff, D. Mayer, and R. Henderson Griffiss AFB, N.Y. RADC Mar. 1981 95 p refs
(Contract F30602-79-C-0163; AF Proj. 2306)
(AD-A099311; RADC-TR-81-22) Avail: NTIS HC A05/MF A01 CSCL 17/8

A multi-angle ellipsometry technique has been developed. The elements are: Measure Delta and Psi for several angles of incidence. Then compare the data with theoretical values which have been calculated from a model that predicts the optical properties for a system comprising several thin film layers on an reflecting substrate. Each film layer has some anisotropy (stress) and optical constants: iterate the model parameters to obtain the best fit with the measured and theoretical values for Delta and Psi. This technique has been applied with success to SiO2 and silicon-on-sapphire thin films. The data reveal a 6 A thick inner layer between the SiO2 film and the silicon substrate. The films have various stress values in the 10 to the 9th power dyne/sq cm range. Strong stress (up to 10 to the 10th power dyne/sq cm) is found in silicon-on-sapphire. Three SOS samples were graded for optical quality; the degree of perfection was inversely related to the amount of stress found. Author (GRA)

N81-26506# Ames Lab., Iowa. Dept. of Engineering Science and Mechanics.
DYNAMIC PHOTOELASTICITY AS AN AID TO SIZING SURFACE CRACK BY FREQUENCY ANALYSIS
A. Singh, C. P. Burger, L. W. Schmerr, and L. W. Zachary Apr. 1980 20 p refs Presented at the Conf. on the Mech. of Nondestructive Testing, Blacksburg, Va., 10-12 Sep. 1980
(Contract W-7405-eng-82)
(IS-M-288; CONF-8009135-1; ERI-80191) Avail: NTIS HC A02/MF A01

A method using Rayleigh or surface waves for sizing surface cracks that have been modeled as machine slots is described. Dynamic photoelasticity was chosen to study the overall wave behavior and the mode conversions of a Rayleigh wave as it interacts with narrow slots cut from the edges of a two-dimensional plate model. This technique gives a full-field visualization of the stresses produced by an elastic wave traveling in a solid. The interaction between a Rayleigh wave and a slot was observed from a sequence of pictures taken with a high-speed Cranz-Schardin camera. The procedures and results are discussed. It was concluded that the ability of dynamic photoelasticity to produce full-field views of elastic stress fields can be used to provide an understanding of the ways in which the subsurface particle motions in Rayleigh waves are affected by a slot. As a consequence the Rayleigh wave property which relates the wavelength to its depth below the surface has been effectively used to find the depth of slots. DOE

N81-26507# Kansas Univ., Lawrence.
COMPOSITE BEAMS WITH WEB OPENINGS
William C. Clawson and David Darwin Oct. 1980 224 p refs (Grant NSF ENG-76-19045)
(PB81-164188; SM-4; NSF/RA-800374) Avail: NTIS HC A10/MF A01 CSCL 13M

An ultimate strength model is developed to predict the strength of composite beams at the web openings in the form of moment shear interaction diagrams. The steel is modeled as an elastic, perfectly plastic material. The yield stress of the steel is defined as a function of the assigned shear stress according to the von Mises yield criterion. The concrete is modeled for ultimate strength behavior. Concrete compressive strength is also defined as a function of the assigned shear stress, based on experimental results. Strain compatibility between the concrete and steel is assumed. The model is compared with experimental results and is used to study the effect of key parameters (material properties, opening size, and opening eccentricity) affecting the strength of composite beams with web openings. A simplified design interaction procedure is presented to conservatively guide the placement of web openings in composite beams. GRA

42 GEOSCIENCES (GENERAL)

N81-26508# Smithsonian Astrophysical Observatory, Cambridge, Mass. Radio and Geoastronomy Div.
DETERMINING GEOPHYSICAL PHENOMENA. A GEOPHYSICAL ANALYSIS OF SATELLITE LASER DATA Final Report, 1 Aug. 1978 - 30 Oct. 1980
E. M. Gaposchkin Mar. 1981 133 p refs
(Contract F19628-78-C-0216; AF Proj. 7600)
(AD-A099018; AFGL-TR-81-0023) Avail: NTIS HC A07/MF A01 CSCL 08/3

Precision laser tracking data on three close-Earth satellites (Geos 1, Geos 2, and Lageos) are analyzed to obtain measurements of ocean tides, body tides, (including the core-mantle resonance) and other mass displacements, from perturbations of the node and inclination. Mean elements are computed for 6.0 years for Geos 1, 4.9 years for Geos 2, and 2.1 years for Lageos. Ocean tides T2, S2, K2, P1, K1, and phi 1 are measured, along with the core mantle resonance at the K1 frequency, as predicted by Poincare, Molodensky and Wahr. The semi-annual body tide deformation is measured. The radiation pressure area to mass ratio for the three satellites is also measured. Author (GRA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N81-26509* National Aeronautics and Space Administration. Pasadena Office, Calif.
UNDERGROUND MINERAL EXTRACTION Patent
Charles G. Miller (JPL, California Inst. of Technology, Pasadena) and James B. Stephens (JPL, California Inst. of Technology, Pasadena) Issued 7 Oct. 1980 13 p Filed 19 Apr. 1978 Sponsored by NASA
(NASA-Case-NPO-14140-1; NASA-Case-NPO-14382-1;

US-Patent-4,226,475; US-Patent-Appl-SN-897832; US-Patent-Class-299-13; US-Patent-Class-166-222; US-Patent-Class-166-77; US-Patent-Class-134-17; US-Patent-Class-299-17; US-Patent-Class-299-20; US-Patent-Class-239-562; US-Patent-Class-239-591) Avail: US Patent and Trademark Office CSCL 08I

A method was developed for extracting underground minerals such as coal, which avoids the need for sending personnel underground and which enables the mining of steeply pitched seams of the mineral. The method includes the use of a narrow vehicle which moves underground along the mineral seam and which is connected by pipes or hoses to water pumps at the surface of the Earth. The vehicle hydraulically drills pilot holes during its entrances into the seam, and then directs sideward jets at the seam during its withdrawal from each pilot hole to comminute the mineral surrounding the pilot hole and combine it with water into a slurry, so that the slurried mineral can flow to a location where a pump raises the slurry to the surface.

Official Gazette of the U.S. Patent and Trademark Office

N81-26510 California Univ., Los Angeles.
SIMULATIONS ASSESSING THE UTILITY OF LEAF PHOTOSYNTHESIS MODELS IN ESTIMATING CROP PRODUCTIVITY Ph.D. Thesis
James Edward Burt 1980 354 p
Avail: Univ. Microfilms Order No. 811217

Two leaf photosynthesis models were compared with a more complex crop growth model in an effort to determine the degree to which spatial variations in biological yield arise from variations in photosynthetic rate. Patterns of yield obtained from simulations for a single growing season over the eastern United States correlate poorly with one another. The models produce different patterns of total seasonal yield and disagree throughout the growing season as well. Further, the models respond very differently to systematic changes in air temperature and data variance. It is concluded that a simple photosynthesis model is not capable of capturing the spatial variation in yield present at this scale, and the differences in the apportionment of photosynthate and resulting feedback on growth rate are much more important than the rate of photosynthesis. Dissert. Abstr.

N81-26511 West Virginia Univ., Morgantown.
FREQUENCY ANALYSIS AND PREDICTION OF MINIMUM STREAMFLOW RATES Ph.D. Thesis
Douglas Gene Boyer 1980 156 p
Avail: Univ. Microfilms Order No. 8110617

The effects of basin characteristics on low stream flows in West Virginia were investigated by developing pertinent deterministic and statistical relationships. Basin, climate, and flow data were collected for 58 basins. A basin storage term was developed, the seasonal flow regime was described, and the recession constant derived. Statistical relationships were developed by simple correlation and least squares regression, and the conservativeness of low flow frequency estimates was analyzed. Frequency estimates of low flows are not conservative with record lengths up to 30 years. Basin storage fluctuation as a volume per year was the most important variable for predicting low flows. Basin area was almost equally efficaceous. A power function for predicting low flow is presented. Low streamflows can be estimated by regression. However, frequency values are not conservative indices of low flows. Dissert. Abstr.

N81-26512 Hawaii Univ., Honolulu.
IMAGE EVALUATION OF LANDSAT DATA FOR MONITORING CHANGE IN FOREST VIGOR: THE OHIA RAIN FOREST DECLINE ON THE ISLAND OF HAWAII Ph.D. Thesis
John Dorward Rockie 1980 213 p
Avail: Univ. Microfilms Order No. 8111345

The use of LANDSAT images for mapping variations in rain forest vigor and density in order to monitor ohia decline on the island of Hawaii is evaluated. Several types of images enhancement were evaluated, including density slicing, color enhancement, multispectral comparisons, densitometry and change detection. Density slicing and color enhancement gave the most reliable results. The principal reasons for low correspondence levels were heterogeneity of both canopy and understory of the rain forest, inaccuracies in generalized vegetation maps used to evaluate density slice maps, and planimetric errors in LANDSAT images due to both geometric errors and misleading pixel portrayal. The change in the decline patterns was too small to be measured by either enhancement of LANDSAT images or interpretation of vegetation maps compiled from aerial photographs.

Dissert. Abstr.

N81-26513 Brown Univ., Providence, R. I.
FORCED BAROCLINIC WAVES Ph.D. Thesis
Timothy Francis Hogan 1980 223 p
Avail: Univ. Microfilms Order No. 8111112

The quasigeostropic, two layer model was used to investigate two problems in forced baroclinic wave theory. A perturbation scheme was established for the linear marginally stable baroclinic wave. For the cases of temporal and spatial forcing with large dissipation, the baroclinic wave activity is strongly correlated with the forcing. A simple model of the general circulation was constructed. The atmosphere is approximated by a two layer model on a beta plane extending from the equator to the pole. The quasigeostrophic equations are separated into their zonal mean and eddy components. A steady Hadley cell is found as the steady solution. This Hadley cell structure is hydrodynamically unstable. Numerically, the most unstable baroclinic wave is found using the nonseparable linearized eddy equations. From the steady zonal equations, a zonal response shape is calculated, and this shape is also frozen in time with an arbitrary function. A system of ordinary differential equations is obtained for the zonal mean and eddy amplitude development. It is found that the final equilibrium state resembles that found in the atmosphere. Dissert. Abstr.

N81-26514*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Apr. - Jun. 1980
Helen N. Paley and Anne B. Kahle, Principal Investigators Aug. 1980 4 p HCMM
(Contract NAS7-100)
(E81-10090; NASA-CR-164086) Avail: NTIS HC A02/MF A01 CSCL 08G

The feasibility of using thermal inertia, inferred from remotely sensed temperature data, to complement LANDSAT reflectivity data for reconnaissance geologic mapping and mineral exploration is under investigation. The bulk of HCMM data tapes was received and processed, and a thermal inertia image of one data set was made. Additional areas of interest were identified on the HCMM photographic products and data tapes were ordered for these areas. During analysis of selected subareas, various sedimentary rock units were distinguished in the Death Valley, California test site and areas of altered rock were identified in the Cuprite/Goldfield, Nevada test site. A.R.H.

N81-26515*# Calspan Advanced Technology Center, Buffalo, N.Y.
APPLICATIONS OF HCMM SATELLITE DATA Quarterly Report, 23 May - 23 Aug. 1980
23 Aug. 1980 10 p HCMM
(Contract NAS5-24263)
(E81-10091; NASA-CR-164089; QR-12) Avail: NTIS HC A02/MF A01 CSCL 05B

Underflight data were radiometrically calibrated at several locations and surface water temperature measurements were made for several areas approximating the field of view of the HCMM sensor in a study of the thermal properties of Lake Ontario and Lake Erie and of the heat island problem in selected areas adjacent to these lakes. The temperatures obtained from the radiometrically collected imagery were then plotted against the apparent temperatures for these same locations obtained from HCMM computer compatible tapes. The sensor calibration provides a foundation for development of a refined model for radiometric correction of HCMM data to produce maps of thermal bar development in Lake Ontario. Thermal patterns of several urban areas were generated from HCMM tapes and scaled to corresponding land use and topographic maps. The resulting map overlays are being interpreted in terms of land use influence on the extend and severity of heat island indicators. A.R.H.

N81-26516*# Texas Univ. at El Paso. Dept. of Geological Sciences.

EVALUATION OF EXISTING KNOWLEDGE OF THE TECTONIC HISTORY AND LITHOSPHERIC STRUCTURE OF SOUTH AMERICA Quarterly Report, 3 Oct. - 31 Dec. 1980

G. R. Keller and E. G. Lidiak, Principal Investigators 31 Dec. 1980 7 p HCMM

(Contract NAS5-26326)

(E81-10092; NASA-CR-164090) Avail: NTIS HC A02/MF A01 CSCL 08G

While data is available on the lithospheric and crustal structure of the Andes region of South America, there is limited knowledge of these aspects of the eastern portion of the continent. For this reason, a surface wave dispersion study of the area was initiated. Long period seismograms were obtained for a tripartite analysis of dispersion. A flow chart of the analysis to be conducted is presented along with a preliminary geologic/tectonic map that was prepared. Efforts to characterize the provinces identified in terms of their geological and geophysical parameters continue. A.R.H.

N81-26517*# Tokyo Univ. (Japan). Geophysics Research Lab.

JAPANESE MAGSAT TEAM. A: CRUSTAL STRUCTURE NEAR JAPAN AND ITS ANTARCTIC STATION. B: ELECTRIC CURRENTS AND HYDROMAGNETIC WAVES IN THE IONOSPHERE AND THE MAGNETOSPHERE Progress Report, 15 Nov. 1980 - 15 Mar. 1981

Naoshi Fukushima, H. Maeda, T. Yukutake, M. Tanaka, S. Oshima, K. Ogawa, M. Kawamura, Y. Miyzaki, S. Uyeda, K. Kobayashi, Principal Investigators et al 28 Mar. 1981 8 p Sponsored by NASA ERTS

(E81-10096; NASA-CR-164094; PR-2) Avail: NTIS HC A02/MF A01 CSCL 08G

Efforts continue in compiling tapes which contain vector and scalar data decimated at an interval of 0.5 sec, together with time and position data. A map of the total force field anomaly around Japan was developed which shows a negative magnetic anomaly in the Okhotsk Sea. Examination of vector residuals from the MGST model shows that the total force perturbation is almost ascribable to the perturbation parallel to the main geomagnetic field and that the contribution from the perturbation transverse to the main field to the total force perturbation is negligibly small. The influences of ionospheric current with equatorial electrojet and of the magnetospheric field aligned current on the dawn-dusk asymmetry of daily geomagnetic variations are being considered. The total amount of electric current flowing through the plane of the Magsat orbit loop was calculated by direct application of Maxwell's equation. Results show that the total electric current is 1 to 5 ampheres, and the current direction is either sunward or antisunward. A.R.H.

N81-26518*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.

ELECTROMAGNETIC DEEP-PROBING (100-1000 kms) OF THE EARTH'S INTERIOR FROM ARTIFICIAL SATELLITES: CONSTRAINTS ON THE REGIONAL EMPLACEMENT OF CRUSTAL RESOURCES Quarterly Progress Report, 31 Dec. 1980 - 31 Mar. 1981

John F. Hermance, Principal Investigator 31 Mar. 1981 5 p ERTS

(Contract NAS5-26138)

(E81-10097; NASA-CR-164095; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 08G

Efforts continue in the development of a computer program for looking at the coupling of finite dimensioned source fields with a laterally heterogeneous Earth. An algorithm for calculating a time-varying reference field using ground-based magnetic observatory data is also under development as part of the production of noise-free estimates of global electromagnetic response functions using Magsat data. A.R.H.

N81-26519*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.

ELECTROMAGNETIC DEEP-PROBING (100-1000 kms) OF THE EARTH'S INTERIOR FROM ARTIFICIAL SATELLITES: CONSTRAINTS ON THE REGIONAL EMPLACEMENT OF CRUSTAL RESOURCES Quarterly Progress Report, 1 Oct. - 31 Dec. 1980

John F. Hermance, Principal Investigator 9 Jan. 1981 12 p ERTS

(Contract NAS5-26138)

(E81-10103; NASA-CR-164097; QPR-2) Avail: NTIS HC A02/MF A01 CSCL 08G

A spherical harmonic analysis program is being tested which takes magnetic data in universal time from a set of arbitrarily space observatories and calculates a value for the instantaneous magnetic field at any point on the globe. The calculation is done as a least mean-squares value fit to a set of spherical harmonics up to any desired order. The program accepts as a set of input the orbit position of a satellite coordinates it with ground-based magnetic data for a given time. The output is a predicted time series for the magnetic field on the Earth's surface at the (r, theta) position directly under the hypothetically orbiting satellite for the duration of the time period of the input data set. By tracking the surface magnetic field beneath the satellite, narrow-band averages crosspowers between the spatially coordinated satellite and the ground-based data sets are computed. These crosspowers are used to calculate field transfer coefficients with minimum noise distortion. The application of this technique to calculating the vector response function W is discussed.

Author

N81-26520*# Business and Technological Systems, Inc., Seabrook, Md.

GEOMAGNETIC FIELD MODELING BY OPTIMAL RECURSIVE FILTERING Quarterly Report, 1 Oct. - 31 Dec. 1980

31 Dec. 1980 3 p ERTS

(Contract NAS5-26250)

(E81-10106; NASA-CR-164100; QR-2) Avail: NTIS HC A02/MF A01 CSCL 08G

Five individual 5 year mini-batch geomagnetic models were generated and two computer programs were developed to process the models. The first program computes statistics (mean sigma, weighted sigma) on the changes in the first derivatives (linear terms) of the spherical harmonic coefficients between mini-batches. The program ran successfully. The statistics are intended for use in computing the state noise matrix required in the information filter. The second program is the information filter. Most subroutines used in the filter were tested, but the coefficient statistics must be analyzed before the filter is run. A.R.H.

N81-26521*# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.

[GRAVITY AND MAGNETIC ANOMALY MODELING AND CORRELATION USING THE SPHERE PROGRAM AND MAGSAT DATA] Quarterly Progress Report, Oct. - Dec. 1980

L. W. Braile, W. J. Hinze, Principal Investigators, and R. R. B. vonFrese Dec. 1980 7 p refs ERTS

(Contract NAS5-22816)

(E81-10115; NASA-CR-164109) Avail: NTIS HC A02/MF A01 CSCL 08G

The spherical Earth inversion, modeling, and contouring software were tested and modified for processing data in the Southern Hemisphere. Preliminary geologic/tectonic maps and selected cross sections for South and Central America and the Caribbean region are being compiled and as well as gravity and magnetic models for the major geological features of the area. A preliminary gravity model of the Andeas Beniff Zone was constructed so that the density columns east and west of the subducted plates are in approximate isostatic equilibrium. The magnetic anomaly for the corresponding magnetic model of the zone is being computed with the SPHERE program. A test tape containing global magnetic measurements was converted to a tape compatible with Purdue's CDC system. NOO data were screened for periods of high diurnal activity and reduced to anomaly form using the IGS-75 model. Magnetic intensity anomaly profiles were plotted on the conterminous U.S. map using the track lines as the anomaly base level. The transcontinental magnetic high seen in POGO and MAGSAT data is also represented in the NOO data. A.R.H.

N81-26522*# Phoenix Corp., McLean, Va.

IMPROVED DEFINITION OF CRUSTAL ANOMALIES FOR MAGSAT DATA Quarterly Report

25 Dec. 1980 2 p ERTS

(Contract NAS5-25882)
(E81-10116; NASA-CR-164110; QR-5) Avail: NTIS HC A02/MF A01 CSCL 08G

Final editing and reduction of the equatorial ground observatory data set was completed. Plots of delineation, and the vertical and horizontal components of the time varying field were generated from these data. Appropriate baselines were derived and deviations from these levels can be used as a continuous measure of the external variations at ground level in the sub-auroral zones. They may also be useful as quantitative measures of the intensity of external field activity. Other data sets assembled for dissemination include (1) Kp and Ap - the planetary magnetic indexes; (2) the international magnetic character indexes-Cp; (3) compilations of magnetic storm sudden commencements; (4) time of interplanetary magnetic sector changes; and (5) Dst-the storm disturbance measure. Fine attitude component data with its increased pointing resolution is reducing residuals by an order of magnitude. A.R.H.

N81-26523*# Phoenix Corp., McLean, Va.
IMPROVED DEFINITION OF CRUSTAL ANOMALIES FOR MAGSAT DATA Quarterly Report
25 Sep. 1980 2 p ERTS
(Contract NAS5-25882)
(E81-10117; NASA-CR-164111; QR-4) Avail: NTIS HC A02/MF A01 CSCL 08G

Ongoing efforts to define and model external magnetic field activities are summarized. Data were obtained and plotted for the five international quiet days of each month Magsat was in orbit. The values of the magnetic field at midnight were also plotted for each of the quiet days. Results show that the zero level of the field fluctuates over the time interval considered. Statistical studies were made for the Kp and Ap indices and more sunspot numbers were obtained for the Magsat period. Satellite data are being thinned and reformatted to make them more amenable to testing the Dst and Sq corrections. The software for processing Magsat tapes is being tested with intermediate attitude data. A.R.H.

N81-26524*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REMOTE SENSING DATA APPLIED TO THE EVALUATION OF SOIL EROSION CAUSED BY LAND-USE. RIBEIRAO ANHUMAS BASIN AREA: A CASE STUDY
Nelson deJesusParada, Principal Investigator, Sergio dosAnjosFerreiraPinto, and Hermann J. H. Kux Dec. 1980 15 p refs Presented at the Intern. Symp. on Erosion and Sediment Transport Meas., Firenzi, Italy, 22-25 Jun. 1981 Sponsored by NASA ERTS
(E81-10121; NASA-CR-164375; INPE-1965-RPE/276) Avail: NTIS HC A02/MF A01 CSCL 05B

Formerly covered by a tropical forest, the study area was deforested in the early 40's for coffee plantation and cattle raising, which caused intense gully erosion problems. To develop a method to analyze the relationship between land use and soil erosion, visual interpretations of aerial photographs (scale 1:25.000), MSS-LANDSAT imagery (scale 1:250,000), as well as automatic interpretation of computer compatible tapes by IMAGE-100 system were carried out. From visual interpretation the following data were obtained: land use and cover tapes, slope classes, ravine frequency, and a texture sketch map. During field work, soil samples were collected for texture and X-ray analysis. The texture sketch map indicate that the areas with higher slope angles have a higher susceptibilty to the development of gullies. Also, the over carriage of pastureland, together with very friable lithologies (mainly sandstone) occuring in that area, seem to be the main factors influencing the catastrophic extension of ravines in the study site. A.R.H,

N81-26525*# Vermont Univ., Burlington. School of Natural Resources.
REMOTE SENSING PROGRAM Annual Report, 1 Jun. 1978 - 31 May 1980
Roy A. Whitmore, Jr., Principal Investigator 31 May 1980 64 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS
(Grant NsG-7453)
(E81-10135; NASA-CR-164123) Avail: NTIS HC A04/MF A01 CSCL 05B

A syllabus and training materials prepared and used in a series of one-day workshops to introduce modern remote sensing technology to selected groups of professional personnel in Vermont are described. Success in using computer compatible tapes, LANDSAT imagery and aerial photographs is reported for the following applications: (1) mapping defoliation of hardwood forests by tent caterpillar and gypsy moth; (2) differentiating conifer species; (3) mapping ground cover of major lake and pond watersheds; (4) inventorying and locating artificially regenerated conifer forest stands; (5) mapping water quality; (6) ascertaining the boat population to quantify recreational activity on lakes and waterways; and (7) identifying potential aquaculture sites. A.R.H.

N81-26526*# National Aeronautics and Space Administration, Washington, D. C.
LANDSAT SUPPORTS DATA NEEDS FOR EPA 208 PLANNING
Sep. 1979 36 p Prepared in cooperation with Council of State Planning Agencies, Washington, D.C. ERTS
(E81-10148; NASA-TM-82382) Avail: NTIS HC A03/MF A01 CSCL 05B

Excerpts from federal legislation and regulations mandating areawide waster treatment management as a means of restoring and maintaining the integrity of the nation's water are presented along with requirements for grants to the states for water quality planning, management, and implementation. Experiences using LANDSAT to identify nonpoint sources of water pollution as well as land/use/land cover features in South Dakota, Kentucky, Georgia, New Jersey, and Texas are described. Present activities suggest that this type of remote sensing is an efficient, effective tool for areawide water quality planning. Interaction with cognizant federal, state, and local government personnel involved in EPA section 208 planning activities can guide the development of new capabilities and enhance their utility and prospect for use. A.R.H.

N81-26527*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FIELD RESEARCH ON THE SPECTRAL PROPERTIES OF CROPS AND SOILS, VOLUME 1 Final Report, 1 Dec. 1979 - 30 Nov. 1980
M. E. Bauer, Principal Investigator, L. L. Biehl, and B. F. Robinson Nov. 1980 173 p ref Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS 2 Vol.
(Contract NAS9-15466; Proj. AgRISTARS)
(E81-10151; NASA-CR-164373; SR-PO-04022-Vol-1; LARS-FR-112680-Vol-1) Avail: NTIS HC A08/MF A01 CSCL 02C

The experiment design, data acquisition and preprocessing, data base management, analysis results and development of instrumentation for the AgRISTARS Supporting Research Project, Field Research task are described. Results of several investigations on the spectral reflectance of corn and soybean canopies as influenced by cultural practices, development stage and nitrogen nutrition are reported as well as results of analyses of the spectral properties of crop canopies as a function of canopy geometry, row orientation, sensor view angle and solar illumination angle are presented. The objectives, experiment designs and data acquired in 1980 for field research experiments are described. The development and performance characteristics of a prototype multiband radiometer, data logger, and aerial tower for field research are discussed. A.R.H.

N81-26528*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
RESEARCH IN THE APPLICATION OF SPECTRAL DATA TO CROP IDENTIFICATION AND ASSESSMENT, VOLUME 2 Final Report, 1 Dec. 1979 - 30 Nov. 1980
C. S. T. Daughtry, Principal Investigator, M. M. Hixson, and M. E. Bauer Nov. 1980 120 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS 2 Vol.
(Contract NAS9-15466; Proj. AgRISTARS)
(E81-10152; NASA-CR-164266; SR-PO-04023-Vol-2;

LARS-FR-112780-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 02C

The development of spectrometry crop development stage models is discussed with emphasis on models for corn and soybeans. One photothermal and four thermal meteorological models are evaluated. Spectral data were investigated as a source of information for crop yield models. Intercepted solar radiation and soil productivity are identified as factors related to yield which can be estimated from spectral data. Several techniques for machine classification of remotely sensed data for crop inventory were evaluated. Early season estimation, training procedures, the relationship of scene characteristics to classification performance, and full frame classification methods were studied. The optimal level for combining area and yield estimates of corn and soybeans is assessed utilizing current technology: digital analysis of LANDSAT MSS data on sample segments to provide area estimates and regression models to provide yield estimates. A.R.H.

N81-26529*# Systems and Applied Sciences Corp., Riverdale, Md.

FINDING THE TIMES THAT SMMR OBSERVED A SHIP Final Report

9 Jul. 1979 46 p

(Contract NAS5-25072)

(NASA-CR-159998; R-SAR-79-01) Avail: NTIS HC A03/MF A01 CSCL 05B

In order to facilitate the coincidence calculations, the coordinates of the ship and the satellite were transformed to the ECO system in which the equatorial plane is the plane of the satellite's orbit. The transformation matrices for each step are presented. The ship could be observed when it was in a band about the equator in the ECO system. The width of the band was determined by the scan pattern of the instrument. T.M.

N81-26530*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

DEVELOPMENT OF A UNIVERSAL WATER SIGNATURE FOR THE LANDSAT-3 MULTISPECTRAL SCANNER, PART 1 Final Report, Jan. - Sep. 1980

Edward H. Schlosser Sep. 1980 27 p refs

(NAS9-15800)

(NASA-CR-161012; LEMSCO-15621-Pt-1; JSC-17003-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 08H

A generalized four channel hyperplane to discriminate water from nonwater was developed using LANDSAT-3 multispectral scaner (MSS) scenes and matching same/next day color infrared aerial photography. The MSS scenes varied in sun elevation angle from 40 to 58 deg. The 28 matching air photo frames contained over 1400 water bodies larger than one surface acre. A preliminary water discriminant, was used to screen the data and eliminate from further consideration all pixels distant from water in MSS spectral space. A linear discriminant was iteratively fitted to the labelled pixels. This discriminant correctly classified 98.7% of the water pixels and 98.6% of the nonwater pixels. The discriminant detected 91.3% of the 414 water bodies over 10 acres in surface area, and misclassified as water 36 groups of contiguous nonwater pixels. E.A.K.

N81-26531*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

DEVELOPMENT OF A UNIVERSAL WATER SIGNATURE FOR THE LANDSAT-3 MULTISPECTRAL SCANNER, PART 2 OF 2 Final Report, Jan. - Sep. 1980

Edward H. Schlosser Sep. 1980 220 p

(Contract NAS9-5800)

(NASA-CR-161010; LEMSCO-15621-Pt-2) Avail: NTIS HC A10/MF A01 CSCL 08H

A generalized four-channel hyperplane to discriminate water from non-water was developed using LANDSAT-3 multispectral scanner (MSS) scences and matching same/next-day color infrared aerial photography. The MSS scenes over upstate New York, eastern Washington, Montana and Louisiana taken between May and October 1978 varied in Sun elevation angle from 40 to 58 degrees. The 28 matching air photo frames selected for analysis contained over 1400 water bodies larger than one surface acre. A preliminary water discriminant was used to screen the data and eliminate from further consideration all pixels distant from water in MSS spectral space. Approximately 1300 pixels, half of them non-edge water pixels and half non-water pixels spectrally close to water, were labelled. A linear discriminant was iteratively fitted to the labelled pixels, giving more weight to those pixels that were difficult to discriminate. This discriminant correctly classified 98.7 percent of the water pixels and 98.6 percent of the non-water pixels. T.M.

N81-26532# CER Corp., Las Vegas, Nev.

WESTERN GAS SANDS PROJECT: UPPER CRETACEOUS AND LOWER TERTIARY STRATIGRAPHY AND NATURAL GAS POTENTIAL OF THE GREATER GREEN RIVER BASIN OF WYOMING

H. E. Newman, III, comp. 2 Apr. 1981 38 p refs

(Contract DE-AC08-79BC-10003)

(DOE/BC-10003/20) Avail: NTIS HC A03/MF A01

Major reserves of natural gas remain to be discovered in the Greater Green River Basin of southwestern Wyoming and northwestern Colorado. This basin, occupying approximately 21,000 square miles, includes four sub-basins. These are the Green River Basin proper, west of the Rock Spring Uplift, and the Red Desert, Washakie, and Sand Wash Basins, on the east side of the uplift. Thick sections of Tertiary and Upper Cretaceous rocks exist throughout most parts of the Greater Green River Basin. Drilling depths to penetrate these sections range from relatively shallow depths on the flanks of the individual basins to depths greater than 20,000 ft in certain areas of the Green River Basin proper. DOE

N81-26533# Decisions and Designs, Inc., McLean, Va.

THE DESIGN OF A MULTIMEDIA MAP-STORE/ SURROGATE TRAVEL INFORMATION SYSTEM Interim Technical Report

Robert N. Kraft, Dennis M. Buede, and John F. Patterson May 1981 85 p

(Contract MDA903-81-C-0192; DARPA Order 4090)

(AD-A099402; TR-81-2-328.23) Avail: NTIS HC A05/MF A01 CSCL 08/2

This report describes the effort to design the software and hardware capabilities of a videodisc mapping and surrogate travel system and to select the various sites to be incorporated into this system. Experts from DARPA's Cybernetics Technology Division and from Interactive Television Corporation (ITC) worked with decision analysts from Decisions and Designs, Inc. (DDI) to extend and elaborate the electronic surrogate travel concept previously developed and demonstrated by DARPA. The general problem was to develop a simple yet innovative conceptual design for a map-store/surrogate travel information system. Such a system must be capable of storing, indexing, and retrieving a wide range of visual and linguistic data, such as maps; aerial, attache, and underwater photography; sequences of shots for surrogate travel; plans and blueprints of key installations; instructional manuals; movies; critical auditory information; panoramas; piloting charts of coasts and harbors; and specialized chart maps indicating the distribution of population, industry, wealth, and vegetation, among others. Design of the map-store/ surrogate travel system and selection of the sites was accomplished though a sequence of three one-day working sessions. The first two sessions were devoted to developing a full range of feasible software and hardware options for the system; developing a set of criteria to determine the sources and kinds of data to be included in the system; and enhancing the man-machine interaction and demonstrability of the system.GRA

N81-26534# Army Military Personnel Center, Alexandria, Va.

USE OF SATELLITE IMAGERY TO MONITOR THE OASIS AGRICULTURE IN THE TURPAN DEPRESSION, XINJIANG UYGUR AUTONOMOUS REGION, PEOPLE'S REPUBLIC OF CHINA: A CASE STUDY M.S. Thesis - Hawaii Univ.

Dorothy Fay Klasse May 1981 107 p refs

(AD-A099265) Avail: NTIS HC A06/MF A01 CSCL 02/4

Satellite imagery can be of very real value to the poorly mapped areas of the world. Because agriculture is dynamic with constantly changing conditions, remote sensing offers the feasibility of monitoring agricultural lands over an extended period of time. The specific objectives of this research are: (1) to estimate the total acreage/hectares of oasis agricultural lands

of the Turpan Depression on selected dates from 1972 to 1978; (2) to prepare thematic maps of the oasis agriculture for the years 1972, 1973, 1977, and 1978; and (3) to assess the agricultural land reclamation efforts within this study area. This thesis dealt with the mapping of oasis agriculture from LANDSAT imagery and the associated problems relating to image resolution, and the lack of ground data and supporting information. Author (GRA)

N81-26535# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LINEAR FILTERING MODELS FOR TERRAIN IMAGE SEGMENTATION
Charles W. Therrien 4 Feb. 1981 28 p refs
(Contract F19628-80-C-0002; AF Proj. 4594)
(AD-A099034; TR-552; ESD-TR-80-245) Avail: NTIS HC A03/MF A01 CSCL 14/5

A method for modeling images of natural terrain is developed and applied to the segmentation of aerial photographic data. An underlying stochastic structure based on linear filtering concepts provides a means of modeling the terrain in local areas of the image. Superimposed on this is a Markov random field that describes transitions from regions of one terrain type to another. Maximum likelihood and maximum a posteriori estimation is applied to estimate regions of similar terrain. Results of application to digitized aerial photographs of a rural area are presented and discussed. Author (GRA)

N81-26536# Army Cold Regions Test Center, Fort Greely, Ark. Geotechnical Research Branch.
METHOD FOR COINCIDENTALLY DETERMINING SOIL HYDRAULIC CONDUCTIVITY AND MOISTURE RETENTION CHARACTERISTICS
Jonathan Ingersoll Mar. 1981 15 p refs
(Contract DOT-FATQWA-707)
(AD-A099136; CRREL-SR-81-2) Avail: NTIS HC A02/MF A01 CSCL 08/13

A constant-head permeameter has been modified to include the essential components of a Tempe cell moisture extractor. With this equipment, tests for saturated hydraulic conductivity (permeability), unsaturated hydraulic conductivity and moisture retention characteristics of the soil can be conducted using the same soil sample. The procedure can be used for both absorption and desorption phases. Test results from four different soils (a glacial till, a fine sand, a silt and a coarse sand) are presented. The effects of density on hydraulic conductivity and moisture retention characteristics are shown. Author (GRA)

N81-26537# Army Cold Regions Test Center, Fort Greely, Ark. Technical Services Div.
AN INVESTIGATION OF THE SNOW ADJACENT TO DYE-2, GREENLAND
H. T. Ueda, M. A. Goff, and K. G. Nielsen Mar. 1981 24 p refs
(Contract MIPR-CS-79-162)
(AD-A099139; CRREL-SR-81-3) Avail: NTIS HC A02/MF A01 CSCL 08/12

Snow samples from five 50 ft (15.2 m) deep holes, augered adjacent to the west side of DEW Line Station Dye-2 in Greenland, were investigated for density and unconfined compressive strength. Forty-two percent of the recovered cores were tested. Ninety-three percent of the samples tested had a length/diameter ratio greater than 2:1. The loading rate was 2 in./min (51 mm/min). Sample end-effects appeared to influence a high percentage of the failures. The heavily disturbed nature of the materials is evidenced in the widely scattered values of density and strength with depth. A minimum and maximum strength value of 31 psi (0.21 MPa) and 1065 psi (7.34 MPa) respectively were obtained from a hole located 50 ft (15.2 m) from the structure. Using an approach similar to that used prior to the DYE-3 move in 1976, a safety factor exceeding 6.5 is obtained against a brittle bearing failure based on a maximum footing design load of 2000 lb/sq ft (96 kPa). Author (GRA)

N81-26538# West Virginia Univ., Morgantown. Dept. of Geology and Geography.
GEOCHEMISTRY STUDIES IN EASTERN KENTUCKY Final Report
J. Negus-deWys Apr. 1981 216 p refs
(Contracts DE-AC21-76ET-12138; DE-AC21-76MO-05194)
(DOE/ET-12138/T3) Avail: NTIS HC A10/MF A01

The results of well cuttings from fourteen wells in the Big Sandy Gas Field are presented. Both X-ray fluorescence and X-ray diffraction were used in analysis. Resultant mineralic data and elemental data were mapped by computer and by hand for five intervals of Ohio Shale and for the Bera/Bedford sequence. Comparisons of the geochemistry trend maps were made with lithology, structure, thermal maturation, gas open flow, and paleoenvironment. Techniques used included visual map comparison, computer map comparison programs utilizing correlation coefficients based on grid derived data sets, cluster analysis, x-y plots, and squared (coefficient of determination). A limited number of regional maps are included. DOE

N81-26539# West Virginia Univ., Morgantown. Dept. of Geology and Geography.
STRATASPECIFIC GEOCHEMICAL TREND MAPS FOR EASTERN KENTUCKY, APPENDIX Final Report
J. Negus-deWys Apr. 1981 175 p
(Contract DE-AC21-76ET-12138)
(DOE/ET-12138/T2) Avail: NTIS HC A08/MF A01

Strataspecific geochemical trend maps representing the contouring of data obtained by X-ray fluorescence and X-ray diffraction analyses of upper Devonian well cuttings from 14 wells in the Big Sandy Gas Field in Kentucky are presented. DOE

N81-26540# Language Services, Knoxville, Tenn.
APPLICATION OF GEOPHYSICAL MEASUREMENT TECHNIQUES IN THE LOCALIZATION OF BRINE AND THE DETERMINATION OF THE STRUCTURE AND BOUNDARIES OF SALT DEPOSITS. LOCALIZATION OF BRINE IN SALT MINES USING HIGH FREQUENCY
[1981] 34 p refs Transl. into ENGLISH from Kali Steinsalz (West Germany), v. 7, no. 8, Oct. 1978 p 359-360 Transl. into ENGLISH from Geol. Jahrbuch (West Germany), v. 90, 1972 p 282-314 Presented the Fifth Intern. Salt Symp., Oct. 1978 Sponsored by DOE Prepared for Oak Ridge National Lab.
(ORNL/tr-4699) Avail: NTIS HC A03/MF A01

The use of acoustic and electromagnetic sensing techniques in the delimitation of brine inclusions in salt deposits and in the determination of the structure of salt deposits are reported. The use of electromagnetic absorption measurements to localize brine inclusions in salt deposits are also described. DOE

N81-26541# Alaska Univ., Fairbanks. Geophysical Inst.
REVIEW OF TECHNOLOGY FOR ARCTIC OFFSHORE OIL AND GAS RECOVERY. VOLUME 2: APPENDICES
W. M. Sackinger 6 Jun. 1980 943 p refs
(Contract DE-AC01-80ET-14317)
(DOE/ET-14317/T2-Vol-2) Avail: NTIS HC A03/MF A01

The US Geological Survey Arctic operating orders, 1979; Det Noske Vertas', rules for the design, construction and inspection of offshore technology 1977; Alaska Oil and Gas association, industry research projects, March 1980; and Arctic Petroleum Operator's Association, industry research projects, January 1980 are presented. A selected additional Arctic offshore bibliography on sea ice, icebreakers, Arctic seafloor conditions, ice-structures, frost heave and structure icing is included.

N81-26542# Geological Survey, Boise Idaho. Water Resources Div.
USING CHANNEL GEOMETRY TO ESTIMATE FLOOD FLOWS AT UNGAGED SITES IN IDAHO Final Report
W. A. Harenberg Aug. 1980 60 p refs Prepared in cooperation with Idaho Transportation Dept., Boise
(PB81-153736; USGS/WRD/WRI-81/002; USGS/WRI-80-32) Avail: NTIS HC A04/MF A01 CSCL 08H

Measurements at bankful stage were made at 136 sites to determine whether predictions of flood discharges using channel-geometry characteristics are as good as or better than predictions using basin characteristics. These measurements are used to determine the variables of bankfull width, area, depth, and velocity. These variables are combined with basin characteristics for the sites and multiple regression techniques are used to select the best combination of variables to estimate the selected floods. GRA

N81-26543# Nevada Univ. -Reno.
CHARACTERIZATION OF STORM RUNOFF IN LAS VEGAS VALLEY, NEVADA
John W. Hess and Douglas E. Zimmerman Nov. 1980 69 p refs
(Contract DI-14-34-0001-8030)
(PB81-156663; PUB-41067; W81-01205; OWRT-A-084-NEV(1)) Avail: NTIS HC A04/MF A01 CSCL 08H

The total salinity of storm runoff is an important consideration. Seven runoff events were sampled at four sites along Flamingo Wash during the period of October 1977 through October 1978. Precipitation occurs from two types of events, both of which will produce runoff. Storm runoff from Flamingo Wash is apparently not an important source of salt loading to the Colorado system. In general, observed TDS during runoff events was less than 1000 mg/l. GRA

N81-26544# Hawaii Univ., Honolulu. Water Resources Research Center.
HAWAIIAN GROUNDWATER GEOLOGY AND HYDROLOGY, AND EARLY MATHEMATICAL MODELS Technical Memo, 1 Oct. 1978 - Sep. 1980
John F. Mink and L. Stephen Lau Sep. 1980 82 p refs
(Contract DI-14-34-0001-9013)
(PB81-157117; TM-62; W81-01376; OWRT-A-077-HI(1)) Avail: NTIS HC A05/MF A01 CSCL 08H

The composition and hydrologic character of Hawaiian rocks are discussed. The hydrologic behavior of the Hawaiian Ghyben-Herzberg Lens was investigated. A critique of early mathematical models is presented. The origin and evolution of the theory of bottom storage was examined. T.M.

N81-26545# Nevada Univ. System, Reno. Desert Research Inst.
SEDIMENT LOADS FROM HEADWATERS OF THE EAST-CENTRAL SIERRA WATERSHEDS
J. A. Nadolski, J. C. Brown, and C. M. Skau Jul. 1980 29 p refs
(Contracts DI-14-34-0001-7060; DI-14-34-0001-9030)
(PB81-160988; PUB-43009; W81-01427; OWRT-A-078-NEV(1)) Avail: NTIS HC A03/MF A01 CSCL 08H

Bedload and suspended sediments were measured for 14 forested watersheds in east-central Sierra Nevada. Snowmelt produced about 90% of annual total sediment yield, and bedload accounted for 20 to 60% of snowmelt yields, stressing the need for selective but comprehensive sampling for management decisions. Empirical predictive equations, based on regression analyses of 13 independent variables, were used to predict 1979 yields. GRA

N81-26546# Iowa Inst. of Hydraulic Research, Iowa City.
FLOW CHARACTERISTICS BELOW FLOATING COVERS WITH APPLICATIONS TO ICE JAMS Ph.D. Thesis
Mustafa Gogus and Jean-Claude Tactinclaux Jan. 1981 185 p refs
(Grant NSF CME-77-12176)
(PB81-160608; IHR-233) Avail: NTIS HC A09/MF A01 CSCL 08L

The stability conditions for floes initially at rest on the underside of a floating cover are described. An empirical expression for the critical densimetric Froude number, based on flow velocity below the cover and floe thickness, at which floes become unstable is proposed in terms of the floe aspect ratio. The floe characteristics between a floating cover were examined, with emphasis on the friction characteristics of the cover and flume bed. Several roughness conditions of the cover and flume bed were investigated. Empirical expressions for the depths of the bed and cover zones are proposed, and the results of the study are included in a method proposed for the calculation of the non-uniform toe region of wide river jams. GRA

N81-26547# National Oceanic and Atmospheric Administration, Washington, D. C.
SATELLITE OBSERVATION OF GREAT LAKES ICE: WINTER 1978-79
Jenifer Wartha-Clark Oct. 1980 44 p
(PB81-167439; NOAA-TM-NESS-112; NOAA-81012703) Avail: NTIS HC A03/MF A01 CSCL 08L

Ice conditions on the five Great Lakes and Lake St. Clair were monitored from satellite imagery. The formation, movement, and dissipation of lake ice were traced from December 1978 through May 1979. Wind speeds and directions were correlated with ice movement, and air temperatures were related to ice formation and decay. GOES and TIROS-N visible images are presented. GRA

N81-26548# California Univ., Santa Barbara. Geography Remote Sensing Unit.
ANALYSIS OF SEASAT-A SAR (SYNTHETIC APERTURE RADAR) DATA FOR THE DETECTION OF OIL ON THE OCEAN SURFACE
John E. Estes, Michael Wilson, and Earl Haijic 1 Oct. 1980 106 p refs
(Contract NA79SAC-00734)
(PB81-153405; NOAA-80123102) Avail: NTIS HC A06/MF A01 CSCL 13B

The smoothing effects of oil slicks on ocean surfaces were examined and two problems were encountered. These were: lack of concurrent surface verification data, and the appearance of so called confusion targets in the imagery. To 'synthesize' necessary surface truth information, a linear deterministic oil trajectory model was developed which sums the effects of winds, currents, and tides to predict hourly oil slick configurations within the area. Using output oil slick trajectory predictions as a guide, a collecion of 128 x 128 byte subimages was gathered from oil affected areas. Zones of reduced backscatter which could not be attributed to oil/surface tension effects (confusion targets) provided a similar set of subimages. GRA

N81-26549# Geological Survey, Rolla, Mo. Water Resources Div.
EVALUATION OF PEAK-FLOW DATA NETWORK OF SMALL STREAMS IN MISSOURI Final Water-Resources Investigations
Leland D. Hauth Oct. 1980 44 p refs Sponsored in part by Missouri Highway and Transportation Commission
(PB81-156242; USGS/WRD/WRI-81/009; USGS/SRI-80-87) Avail: NTIS HC A03/MF A01 CSCL 08H

Standard regression models were used as a tool to evaluate the transferability of streamflow characteristics for the small-streams network in Missouri. Tests for adequacy of record length and sample size were made. Results indicate that neither additional records nor sampling sites would substantially improve the standard error of the regression. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-26550 California Univ., San Diego.
STUDIES IN ENERGY CONSERVATION AND TECHNOLOGY Ph.D. Thesis
Michael Robert Brambley 1981 344 p
Avail: Univ. Microfilms Order No. 8111884

An integrated methodology for evaluating energy conservation devices is presented. Essential features are: experimental measurements of the properties of the devices, analytic models of performance over the device lifetimes, net energy analyses, economic evaluations using life cycle costing, and field studies to determine actual performances. Detailed applications are presented for selected fenestration devices. General relations are derived for life cycle costs, life cycle savings and payback periods associated with energy conserving devices for consumers. These are applied for parametric evaluation of the efficacy of retrofitting

ceiling insulation and fenestration devices in San Diego County. Equations are presented for estimating heat transfer through eight types of fenestrations using the properties of the shading devices and the conditions of the interior and exterior environments.
Dissert. Abstr.

N81-26551 Auburn Univ., Ala.
PERFORMANCE PREDICTION METHOD FOR SOLAR HEATING SYSTEMS Ph.D. Thesis
Rajinder Singh Chauhan 1980 63 p
Avail: Univ. Microfilms Order No. 8105642

A performance prediction method is presented for liquid based solar heating systems characterized by a minimum useful temperature, T min. By decoupling heat withdrawal from heat collection, an important dimensionless parameter theta, was identified as a measure of the sensitive heat gain by the storage fluid. An exact relation for solar fraction, f, was obtained; f = R - (1 + theta/2)S, where R and S are dimensionless parameters defined with respect to the load on the system. Utilizability was introduced in this equation by assuming symmetrical collector operation. Thus a new equivalent correlaton, f = thetaR/(1 + 0.5 R sub L was obtained where R sub L is a dimensionless loss parameter. Dissert. Abstr.

N81-26552*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SCHOTTKY BARRIER CELL AND METHOD OF FABRICATING IT Patent Application
Richard J. Stirn (JPL, California Inst. of Technology, Pasadena) and Yea-chuan M. Yeh, inventors (to NASA) (JPL, California Inst. of Technology, Pasadena) Filed 16 Jan. 1981 33 p Sponsored by NASA
(NASA-Case-NPO-13689-3; US-Patent-Appl-SN-225494) Avail: NTIS HC A03/MF A01 CSCL 10A

The cell consists of a barrier formed by a polycrystalline active semiconductor layer of GaAs and a thin metal layer. The active semiconductor layer is grown on a polycrystalline semiconductor layer of germanium, serving as a substrate. The latter is first deposited with submicron crystal sizes and thereafter recrystallized so as to increase the crystal sizes to not less than 5-10 microns in size. This process eliminates the need for an expensive single crystal wafer. T.M.

N81-26553*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SCHOTTKY BARRIER CELL AND METHOD OF FABRICATING IT Patent Application
Richard J. Stirn (JPL, California Inst. of Technology, Pasadena) and Yea-chuan M. Yeh, inventors (to NASA) (JPL, California Inst. of Technology, Pasadena) Filed 16 Jan. 1981 33 p Sponsored by NASA
(NASA-Case-NPO-13689-4; US-Patent-Appl-SN-225501) Avail: NTIS HC A03/MF A01 CSCL 10A

The cell consists of a barrier formed by a polycrystalline active semiconductor layer of GaAs and a thin metal layer. The active semiconductor layer is grown on a polycrystalline semiconductor layer of germanium, serving as a substrate. The latter is first deposited with submicron crystal sizes and thereafter recrystallized so as to increase the crystal sizes to not less than 5-10 microns in size. The process eliminates the need for an expensive single crystal wafer. T.M.

N81-26554*# AeroChem Research Labs., Inc., Princeton, N. J.
DEVELOPMENT OF PROCESSES FOR THE PRODUCTION OF SOLAR GRADE SILICON FROM HALIDES AND ALKALI METALS, PHASE 1 AND PHASE 2 Final Report, Oct. 1979 - Feb. 1981
C. R. Dickson, R. K. Gould, and W. Felder Mar. 1981 66 p refs Sponsored in part by DOE Prepared for JPL
(Contract JPL-955491)
(NASA-CR-164480; DOE/JPL-955491-81/6; JPL-9950-552; AeroChem-TP-410) Avail: NTIS HC A04/MF A01 CSCL 10A

High temperature reactions of silicon halides with alkali metals for the production of solar grade silicon are described. Product separation and collection processes were evaluated, measure heat release parameters for scaling purposes and effects of reactants and/or products on materials of reactor construction were determined, and preliminary engineering and economic analysis of a scaled up process were made. The feasibility of the basic process to make and collect silicon was demonstrated. The jet impaction/separation process was demonstrated to be a purification process. The rate at which gas phase species from silicon particle precursors, the time required for silane decomposition to produce particles, and the competing rate of growth of silicon seed particles injected into a decomposing silane environment were determined. The extent of silane decomposition as a function of residence time, temperature, and pressure was measured by infrared absorption spectroscopy. A simplistic model is presented to explain the growth of silicon in a decomposing silane enviroment. E.A.K.

N81-26555*# Applied Concepts Corp., Reston, Va.
USAF SOLAR THERMAL APPLICATIONS OVERVIEW Final Report
J. Scott Hauger and James A. Simpson 4 May 1981 60 p
(Contract JPL-955887)
(NASA-CR-164481; JPL-9950-546, TR-03-81) Avail: NTIS HC A04/MF A01 CSCL 10A

Process heat applications were compared to solar thermal technologies. The generic process heat applications were analyzed for solar thermal technology utilization, using SERI's PROSYS/ECONOMAT model in an end use matching analysis and a separate analysis was made for solar ponds. Solar technologies appear attractive in a large number of applications. Low temperature applications at sites with high insolation and high fuel costs were found to be most attractive. No one solar thermal technology emerges as a clearly universal or preferred technology, however, solar ponds offer a potential high payoff in a few, selected applications. It was shown that troughs and flat plate systems are cost effective in a large number of applications. E.A.K.

N81-26556*# Comstock and Wescott, Inc., Cambridge, Mass.
EXTENDED DEVELOPMENT OF A SODIUM HYDROXIDE THERMAL ENERGY STORAGE MODULE Final Report
Richard E. Rice, Peter E. Rowny, and Barry M. Cohen Sep. 1980 235 p refs
(Contracts DEN3-138; DE-A101-77ET-26945; EC-77-A-31-1034)
(NASA-CR-165206; DOE/NASA/0138-1) Avail: NTIS HC A11/MF A01 CSCL 10C

The post-test evaluation of a single heat exchanger sodium hydroxide thermal energy storage module for use in solar electric generation is reported. Chemical analyses of the storage medium used in the experimental model are presented. The experimental verification of the module performance using an alternate heat transfer fluid, Caloria HT-43, is described. Based on these results, a design analysis of a dual heat exchanger concept within the storage module is presented. A computer model and a reference design for the dual system (storage working fluid/power cycle working fluid) were completed. The dual system is estimated to have a capital cost of approximately one half that of the single heat exchanger concept. J.D.H.

N81-26557*# Ducat Investments, Inc., Kansas City, Kans.
SOLAR SPACE HEATING INSTALLED AT KANSAS CITY, KANSAS Final Report
May 1981 135 p refs
(Contract EG-77-A-01-4079)
(NASA-CR-161763) Avail: NTIS HC A07/MF A01 CSCL 10A

The solar energy system was constructed with the 48,800 square feet warehouse to heat the warehouse area of about 39,000 square feet while an auxiliary energy system heats the office area of about 9,800 square feet. The building is divided into 20 equal units, and each has its own solar system. The modular design permits the flexibility of combining multiple units to form offices or warehouses of various size floor areas as required by a tenant. Each unit has 20 collectors which are mounted in a single row. The collectors are double glazed flat plate collectors with a gross area of 7,800 sq ft. Air is heated either through the collectors or by the electric resistance duct coils. Extracts from the site files, specifications, drawings, installation, operation and maintenance instructions are presented. T.M.

N81-26558*# Cornell Univ., Ithaca, N. Y.
EBIC AND HVTEM STUDIES OF RTR SILICON RIBBON
B. Cunningham, H. Strunk (Max Planck Inst. Fuer Metallforschung), and D. Ast Apr. 1981 17 p refs
(Contract JPL-954852)
(NASA-CR-164526; JPL-9950-520; DOE/JPL-7) Avail: NTIS HC A02/MF A01 CSCL 10A

The defect structure of RTR ribbon #6-731, run 803 was studied. Prior to laser recrystallization the defect structure consists of closely spaced twin and grain boundaries. Precipitation of impurities occurs after laser recrystallization. The observation of electrically active defects in EBIC was correlated with HVTEM studies. Pairs of electrically active defects in twin boundaries are due to stacking faults connecting the twin boundaries. T.M.

N81-26559# Energietechnik G.m.b.H., Essen (West Germany). Studiengesellschaft fuer Energie-Umwandlung, -Fortleitung und -Anwendung.
LONG-TERM ENERGY STORAGE TANKS FOR DWELLINGS AND SOLAR HOUSE ARCHITECTURE Final Report
Bonn Bundesministerim fuer Forschung und Technologie Dec. 1980 93 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with Baehr u. Gansfort, Architekten
(BMFT-FB-T-80-173-Pt-A/B; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

The design and installation of hot water storage tanks as accumulators of solar energy is presented. Solar house architecture which maximizes roof, solar collector energy absorption potential is then considered. Proposals for residential areas which include solar houses are made. For individual titles, see N81-26560 through N81-26561.

N81-26560# Energietechnik G.m.b.H., Essen (West Germany). Studiengesellschaft fuer Energie- Umwandlung, -Fortleitung und -anwendung.
LONG-TERM ENERGY STORAGE TANKS, PART A Final Report
Bernd Dietrich *In its* Long-Term Energy Storage Tanks for Dwelling and Solar House Arch. Dec. 1980 p 5-33 refs In GERMAN (For primary document see N81-26559 17-44)
Avail: NTIS HC A05/MF A01

Low cost storage of solar energy in decentralized large hot water accumulation tanks for dwellings was studied. Integration of the tank into a practical, economical solar energy collector system was carried out. The experience gained with the construction and operation of several test tanks was used to design a large volume, cubic, compact hot water tank whose prefabricated individual parts are easily transported into a cellar and assembled without difficulty. Examples of installations are shown. The optimization scheme for the solar collector/hot water accumulation interface is also presented. Solar energy conversion investigations show a considerable improvement in prolonged system effectiveness, particularly when collectors with lower efficiencies are used. Author (ESA)

N81-26561# Energietechnik G.m.b.H., Essen (West Germany).
SOLAR HOUSE ARCHITECTURE, PART B Final Report
Karl-Heinz Gansfort *In its* Long-term Energy Storage Tanks for Dwellings and Solar House Arch. Dec. 1980 p 34-93 refs In GERMAN (For primary document see N81-26559 17-44)
Avail: NTIS HC A05/MF A01

Solar houses were designed which are architecturally practical, while maximizing the efficiency of solar collector layouts. The attributes of various house designs are discussed, stressing the implementation of roof mounted, flat solar collectors. The collectors are integrated through heat exchangers with the domestic hot water and space heating systems. How such solar houses could be included in a residential development area plan was also studied. Different development area blueprints and models are shown and assessed for their social as well as economic benefits. Author (ESA)

N81-26562# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
COMPUTERIZED PATTERN RECOGNITION APPLIED TO BATTERY TESTING Final Report, Apr. 1977 - Mar. 1980
Sam P. Perone Dec. 1980 3 p refs
(Contract N00014-77-C-0353; NR Proj. 359-650)
(AD-A099410) Avail: NTIS HC A02/MF A01 CSCL 10/3

The primary goal of this work has been to develop non-destructive testing methods as a screening procedure for batteries to predict lifetime and identify probably failure mechanisms. A secondary goal has been to develop criteria for predicting imminent failure from battery performance data. We believe that these goals can be met by the application of computerized pattern recognition to the evaluation of measureable features. In the studies supported by this ONR contract, pattern recognition techniques have been used to analyze data collected previously in established battery testing programs. Because of the ability to evaluate multivariate relationships it was possible to identify previously unobservable multi-dimensional correlations between test data obtained very early in a battery's life-time and its life expectancy and/or failure mechanism. It was the objective of these initial studies to identify the most meaningful types of measurements for lifetime prediction and to establish the feasibility of lifetime prediction. The second function to be provided by pattern recognition methods is to evaluate test data generated subsequently by the new short-term screening tests developed. This will involve collaborative efforts with other laboratories to generate such a data base. Probably several iterations in this procedure will be required before an optimum set of short-term measurements is identified. Such studies are prescribed for future work. Author (GRA)

N81-26563# Virginia Polytechnic Inst. and State Univ., Blacksburg.
CdSiAs2 THIN FILMS SOLAR CELL APPLICATIONS Quarterly Report, 1 Oct. - 31 Dec. 1979
L. C. Burton and L. H. Slack Feb. 1980 17 p refs
(Contract DE-AC02-79ET-23007)
(DOE/ET-23007/3) Avail: NTIS HC A02/MF A01

Sputtering studies of CdSiAs2 films continued. An improved substrate was developed (Ta film on 7059 glass) for post-deposition heat treatments, although films still have mechanical defects. CdS/CdSiAs2 and In/CdSiAs2 junctions were formed on heat treated CdSiAs2 films. Both junction types exhibit rectifying behavior, although with little photovoltaic response. Poor yield and unstable characteristics are attributed to mechanical defects in the CdSiAs2 films. The new multitarget sputtering unit is now installed and operating. DOE

N81-26564# Delaware Univ., Newark. Inst. of Energy Conversion.
Zn3P2 AS AN IMPROVED SEMICONDUCTOR FOR PHOTOVOLTAIC SOLAR CELLS Quarterly Report, 1 Sep. - 31 Nov. 1980
M. Brushman, A. Catalano, and P. S. Nayar 1980 57 p refs
(Contract DE-AC02-76CH-00178)
(SERI/PR-9062-1-T5; QR-9) Avail: NTIS HC A04/MF A01

Frequency and voltage dependent capacitance measurements of ZnO/Zn3P2 heterojunctions were made and the results interpreted according to a model which considers the total capacitance arising from contributions due to the depletion layer capacitance, interface charges and a dipole charge. The capacitance of the devices is anomalously high at low frequencies but agrees well with the value calculated from the bulk carrier density at 1 MHz. The data suggest a significant contribution to the capacitance from the charging and discharging of interface states. Direct evidence for a relationship between defects in the Zn3P2 (grains boundaries, dislocations, etc.), and the collected current were found by comparing EBIC images of ZnO/Zn3P2 devices with the etched surfaces of the samples. DOE

N81-26565# Research Triangle Inst., Research Triangle Park, N. C.
DEVELOPMENT OF HIGH-EFFICIENCY, LOW-COST ZnSiAs2 SOLAR CELLS Final Report, 9 Apr. 1979 - 9 Jun. 1980
J. E. Andrews 1980 42 p refs
(Contract DE-AC04-79ET-23001)
(DOE/ET-23001/T6) Avail: NTIS HC A03/MF A01

The development of a ZnSiAs2/Si-web cascade solar cell is described. Calculations indicate, given a suitable material quality, that 23% efficiencies may be possible and that the Si-web substrate and materials proposed for this cell offer the potential for meeting the cost goals. Significant results include the

successful conversion of the original open tube vapor phase epitaxial growth system to an organometallic growth approach which in turn led to reduced carrier concentrations, and improved material quality. Additionally, epitaxial growth was obtained on alpha-Al2O3 and Si substrates. ZnSiAs2/Si structures were fabricated in which carrier collection from both sides of the interface was observed using the electron beam induced current measurement technique. N-type impurity doping experiments were initiated with the objective of synthesizing n-ZnSiAs2 via substitutional doping. DOE

N81-26566# Technical Information Center, Oak Ridge, Tenn. Technical Information Center.
APPROPRIATE TECHNOLOGY: A BIBLIOGRAPHY
L. M. Thompson, ed. Mar. 1981 56 p
(DOE/TIC-3385) Avail: NTIS HC A04/MF A01

This bibliography of 191 citations and abstracts contains the entries on the subject that appear in the DOE Energy Data Base as of February 28, 1981. The citations are arranged by subject category, with each category first ordered alpha-numerically by report number followed by an inverse chronological order for books, monographs, and journals. Corporate, author, subject, contract number, and report number indexes follow the abstracts. DOE

N81-26567# Geological Survey, Denver, Colo.
COLORADO GEOTHERMAL COMMERCIALIZATION PROGRAM. GEOTHERMAL ENERGY OPPORTUNITIES AT FOUR COLORADO TOWNS: DURANGO, GLENWOOD SPRINGS, IDAHO SPRINGS AND OURAY
Barbara A. Coe and Judy Zimmerman Jan. 1981 66 p refs
(Contract DE-FC07-79ID-12018)
(DOE/ID-12018/8) Avail: NTIS HC A04/MF A01

The first area of investigation was the site itself: its geographic, population, economic, energy demand characteristics and the attitudes of its residents relative to geothermal development potential. Secondly, the resource potential is described to the extent it is known, along with information concerning any exploration or development that was conducted. The third item investigated was the process required for development. There are financial, institutional, environmental, technological and economic criteria for development that must be known in order to realistically gauge the possible development. Planned, proposed and potential development are all described, along with a possible schedule for that development. An assessment of the development opportunities and constraints are included. DOE

N81-26568# Natural Resources Corp., Brooklyn Park, Minn.
USING A WIND ELECTRIC SYSTEM TO GENERATE POWER INTO A UTILITY GRID: A PROJECT IN SOUTH CENTRAL RURAL MINNESOTA Final Report
Tom Griffin and Merle Tate 1981 22 p
(Contract DE-FG02-79R5-10134)
(DOE/R5-10134/1) Avail: NTIS HC A02/MF A01

Design specifications are presented for the Jacobs 10 KVA wind turbine system. DOE

N81-26569# Pease (J. M.) Associates, Charlotte, N.C.
PASSIVE SOLAR COMMERICAL BUILDINGS: DESIGN ASSISTANCE AND DEMONSTRATION PROGRAM, MOUNT AIRY PUBLIC LIBRARY, PHASE 1 Final Report
26 Jan. 1981 284 p Prepared jointly with Mazria (Edward) and Associates
(Contract DE-FC02-80CS-30329)
(DOE/CS-30329/T1) Avail: NTIS HC A13/MF A01

The final design of the library is given. Incremental passive design costs are discussed. Performance and economic analyses are made and the results reported. The design process is thoroughly documented. Considerations discussed are: building energy needs; site energy potentials, matching energy needs with site energy potentials, design indicators for best strategies and concepts, schematic design alternatives, performance testing of the alternatives, design selection, and design development. Weather data and Duke Power electric rates are included. DOE

N81-26570# Theisen (Phillip), Madison, Wis.
LOW COST PROCESS HEAT RECOVERY Interim Report
Phillip Theisen and James McCray 1980 32 p refs
(Contract DE-FG02-80R5-10251)
(DOE/R5-10251/1) Avail: NTIS HC A03/MF A01

Waste heat is analyzed in terms of recovery potential, economics, heat exchanger and system design, and computer programs. The heating demand and heat recovery potential at a neighborhood bakery was assessed. The feasibility of waste heat recovery systems is analyzed using life cycle cost and life cycle savings. For a first approximation, hand calculations were performed for air-to-air flat plate, fin plate, and liquid-to-air tube type heat exchangers using the temperature and mass flow data from a pizza restaurant in Madison. Then a heat exchanger analysis program was written in interactive BASIC. The analysis indicates that heat recovery using the flat plate and fin plate exchanger designs is technically feasible and yields high effectiveness. DOE

N81-26571# Wisconsin Energy Extension Service, Madison.
MAKING OF A SOLAR VILLAGE: A CASE STUDY OF A SOLAR DOWNTOWN DEVELOPMENT PROJECT AT SOLDIER GROVE, WISCONSIN
William S. Becker 1980 52 p refs
(Contract W-31-109-eng-38)
(DOE/TIC-11420) Avail: NTIS HC A04/MF A01

A master plan for the development of the village is presented. The planning procedures are described and include the choosing of building designs, the involvement of the citizens, and the analysis of legal problems. A view of other communities trying similar techniques is presented. T.M.

N81-26572# Johnson (Alfred L.), Manhattan Beach, Calif.
SOLAR POWERED CIRCULATION PUMP DEVELOPMENT Final Report
Alfred L. Johnson Sep. 1980 64 p refs
(Contract DE-FG03-78SF-02005)
(DOE/SF-02005/T1) Avail: NTIS HC A04/MF A01

The state-of-the-art of liquid piston heat engines was examined. Next, a morphological analysis of the original concept was performed. An analysis of the pump performance from a theoretical basis was performed by deriving and solving the equations governing the cycle. The results are documented. An experimental evaluation of the condensing phenomena was performed. It was assumed that the boiling could be conducted in the solar panel. A number of solar panel designs were examined, and the most appropriate type of solar panel is described. A 1/4th scale unit was fabricated and tested. The overall efficiency was approximately 1% at the design point, compared with a theoretical limit of 1.6% for the given operating conditions. The production costs of the full size pump were examined. Systems integration aspects were considered and the results are presented. DOE

N81-26573# Hirai (W. A.) and Associates, Inc., Hilo, Hawaii.
HYDROELECTRIC POWER IN HAWAII. A REPORT ON THE STATEWIDE SURVEY OF POTENTIAL HYDROELECTRIC SITES
Curtis A. Beck Feb. 1981 107 p refs
(Contract DE-FC49-80R9-10031)
(DOE/R9-10031/T1) Avail: NTIS HC A06/MF A01

The major conclusion is that hydropower resources in the State of Hawaii are substantial, and they offer the potential for major increases in hydropower generating capacity. Hydropower resources on all islands total about 50 MW of potential generating capacity. Combined with the 18 MW of existing hydropower capacity, hydropower resources potentially could generate about 307 million kWh of electric energy annually. This represents about 28% of the present combined electricity needs of the Neighbor Islands, Kauai, Molokai, Maui, and the Big Island. Hydropower resources on Kauai equal 72% of that island's electricity needs; on Molokai, 40%, on the Big Island, 20%; and on Maui, 18%. DOE

N81-26574# Los Alamos Scientific Lab., N. Mex.
FUEL CELLS FOR AUTOMOTIVE APPLICATIONS: OVERVIEW
J. Byron McCormick 1980 15 p refs Presented at Elec. and Hybrid Vehicle Advanced Technol. Seminar, Pasadena, Calif., 8 Dec. 1980 Submitted for publication
(Contract W-7405-eng-36)

(LA-UR-81-373; CONF-801242-2) Avail: NTIS HC A02/MF A01

Projections are made of fuel cell technology for vehicular use. The fuel used to provide hydrogen to a phosphoric acid fuel cell is assumed to be methanol. Experimental performance data for a golf cart is discussed. The design, economics, and predicted performance for a fuel cell retrofitted x-car with lead acid batteries for peaking power, are described. The technical and economic feasibility of using fuel cells in city buses, vans and passenger cars are examined. It is concluded that the fuel cell/battery hybrid vehicle will have the advantages of high efficiency, i.e., 53 percent improvement in fuel economy, long fuel cell life, performance comparable to IC engine vehicles, low maintenance, petroleum fuel conservation, low pollution, and quiet operation. From a comparison of the lifetime costs of conventional vehicles versus fuel cell vehicles, it is concluded that commercialization of fuel cells for buses is most feasible followed by van and automobile applications. DOE

N81-26575# Los Alamos Scientific Lab., N. Mex.

SOLAR LOAD RATIO METHOD APPLIED TO COMMERCIAL BUILDING ACTIVE SOLAR SYSTEM SIZING

Norman M. Schnurr, Bruce D. Hunn, and Kenneth D. Williamson, III 1981 31 p refs Presented at the 3rd Ann. Systems Simulation, Econ. Analysis/Solar Heating and Cooling Operation Results Conf., Reno, Nev., 27 Apr. - 1 May 1981

(Contract W-7405-eng-36)

(LA-UR-80-3040; CONF-810405-1) Avail: NTIS HC A03/MF A01

The DOE-2 building energy analysis computer program is described. It is capable of calculating the loads and of simulating various control strategies in detail for both residential and commercial buildings and yet is computationally efficient enough to be used for extensive parameteric studies. In addition to a Building Service Hot Water System and a combined space heating and hot water system using liquid collectors for a commercial building analyzed previously, a space heating system using an air collector is analyzed. A series of runs is made for systems using evacuated tube collectors for comparison to flat-plate collectors, and the effects of additional system design parameters are investigated. Also, the generic collector types are characterized by standard efficiency curves, rather than by detailed collector specifications. DOE

N81-26576# California Univ., Berkeley. Lawrence Berkeley Lab.

NUMERICAL STUDIES OF THE ENERGY SWEEP IN FIVE-SPOT GEOTHERMAL PRODUCTION/INJECTION SYSTEMS

M. J. OSullivan and K. Pruess Dec. 1980 11 p refs Presented at 6th Ann. Workshop on Geothermal Reservoir Engr., Stanford, Calif., 16 Dec. 1980

(Contract W-7405-eng-48)

(LBL-12166; CONF-801233-5) Avail: NTIS HC A02/MF A01

A vapor dominated, single layer reservoir is considered, next a vapor dominated, four layer reservoir, and finally a liquid dominated, single layer reservoir. In each case varying injection rates are considered and in some cases the injection is changed at different times. The SHAFT9 simulator was used to calculate the reservoir behavior in each case. The calculations are made for a five spot configuration of alternate, off-set rows of producers and injectors. A calculation mesh with 34 nodes is used, which is barely sufficient to give accurate results. In fact, some of the results exhibit small oscillations with time due to this relatively coarse discretization. DOE

N81-26577# Battelle Pacific Northwest Labs., Richland, Wash.

ECONOMICS OF GEOTHERMAL, SOLAR, AND CONVENTIONAL SPACE HEATING

Linda L. Fassbender, Clarence H. Bloomster, and Bobi A. Price 1980 4 p refs Presented at the Geothermal Resources Council Ann. Meeting, Salt Lake City, 9 Sep. 1980

(Contract DE-AC06-76RL-01830)

(PNL-SA-8503; CONF-800920-29) Avail: NTIS HC A02/MF A01

With the recent price increases in imported oil and natural gas and the planned decontrol of domestic prices, geothermal and solar energy becomes competitive for residential space heating throughout most of the country. Geothermal energy could competitively provide about 40% of the national demand for space heat and domestic hot water (about 7 quads based on 1980 demands). Nearly all of the geothermal energy demand would be in high population density areas. Solar energy could competitively provide about 50% (about 9 quads) of the annual demand. Most of the solar energy demand would be concentrated in suburban and rural areas. Conventional energy should remain competitive for about 30% (about 5 quads) of the annual demand. Conventional energy demand would be concentrated in the South and as supplemental energy for solar/conventional systems. Geothermal solar, and conventional energy would be equally competitive for about 20% of the annual demand, which is why the individual market shares add to 120%. DOE

N81-26578# Battelle Pacific Northwest Labs., Richland, Wash. Atmospheric Sciences Dept.

EFFECT OF SITE WIND CHARACTERISTICS ON ENERGY PRODUCTION

W. T. Pennell and H. L. Wegley Dec. 1980 20 p refs Presented at the 3rd Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 12-15 Dec. 1980

(Contract DE-AC06-76RL-01830)

(PNL-SA-9066; CONF-801210-20) Avail: NTIS HC A02/MF A01

The effect of differences in wind characteristics on estimates of wind turbine performance is examined. Net energy production over a given period can be estimated if both the performance characteristics of the turbine and the wind speed probability density function (PDF) are known. Simulations covering a range of PDFs and machine performance characteristics showed that reasonable estimates of net energy production can be made using simple, analytical PDF's. The analytical PDF's only require knowledge of the average wind speed at a site. Some wind energy applications require knowledge of how temporal variations in turbine output interact with temporal variations in the load. The effect of variations in the diurnal modulation of wind speed on load matching was examined by simulating the energy transfer between a utility and a residence equipped with a small wind turbine generator. Turbine performance was simulated a six sites having a wide range of diurnal characteristics. DOE

N81-26579# Los Alamos Scientific Lab., N. Mex.

BIO-ENERGY: A TAXONOMY OF LAND USE IMPACTS

Virginia Kay Barber Parsons 1981 20 p refs Presented at the 8th Energy Technol. Conf. and Exposition, Washington, D.C., 9-11 Mar. 1981

(Contract W-7405-eng-36)

(LA-UR-81-549; CONF-810315-4) Avail: NTIS HC A02/MF A01

Potential land use impacts are identified from each of the four major bio-energy technology classes: anaerobic digestion; fermentation; gasification; and direct combustion. Each technology class is discussed with respect to each of the five major land use categories in the US: production of food and fiber; energy, industry, and commerce; housing and community; transportation and recreation; and open space. DOE

N81-26580# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Division.

TECHNOLOGICAL ACTIVITIES FOR HIGH PERFORMANCE RECEIVERS Final Report

Gunther Schmidt, Erich Kirner, and Helmut Zewen Dec. 1980 86 p refs In GERMAN; ENGLISH summary

(BMFT-FB-T-80-133; UR-39979-79; ISSN-0340-7608) Avail: NTIS (US Sales only) HC A04/MF A01; DOE Depository Libraries

For solar thermal power plants, the energy transfer efficiency from the incident solar radiation into the heat transfer medium has a direct impact on the overall plant efficiency and influences the size of the cost effective collector field. For this reason technological activities were accomplished for high performance receivers to be operated in closed Rankine cycles with organic heat transfer media at temperatures between 350 C to 400 C and gas turbine cycles at temperatures between 800 C to 900 C. Under simulated test conditions the thermal and mechanical resistance of the structure and the behavior of different

heat transfer media with respect to thermal efficiency and stability were analyzed. DOE

N81-26581# Oak Ridge National Lab., Tenn. Engineering Technology Div.
OVERVIEW OF THE US INDUSTRIAL THERMAL ENERGY STORAGE PROGRAM
M Olszewski 1981 13 p refs
(Contract W-7405-eng-26)
(CONF-810423-2) Avail: NTIS HC A02/MF A01

Thermal energy storage can contribute to industrial conservation efforts directed at saving premium (gas and oil) fuels, which is a priority national need. This can be done by using storage to allow the recycling of industrial reject heat to reduce primary energy consumption or to allow alternate fuels to replace gas and oil. Industrial thermal energy storage efforts include three major areas: in-plant reuse of industrial reject heat; external reuse of industrial reject heat for applications in the industrial or buildings sector; and use of alternate fuels to replace gas and oil. The program currently includes engineering field tests in the brick and aluminum industries. In addition, technology transfer activities are underway in the pulp and paper industry. DOE

N81-26582# Department of Energy, Washington, D. C. Economic Regulatory Administration.
STATE POWER PLANT PRODUCTIVITY PROGRAMS
Feb. 1981 115 p refs
(DOE/RG-0053) Avail: NTIS HC A06/MF A01

The findings of a working group formed to review the status of efforts by utilities and utility regulators to increase the availability and reliability of generating units are presented. The Federal government has been working cooperatively with utilities, utilty organizations, and with regulators to encourage and facilitate improvements in power plant productivity. Cooperative projects undertaken with regulatory and energy commissions in California, Illinois, New York, Ohio, Texas, North Carolina and Michigan are described. The cost effectiveness of proposed availability improvement projects should be determined within the context of opportunities for operating and capital improvements available to an entire utility. DOE

N81-26583# Oak Ridge National Lab., Tenn. Mathematics and Statistics Research Dept.
SIMULATION OF A PCM STORAGE SUBSYSTEM FOR AIR CONDITIONING ASSIST
Alan D. Solomon Apr. 1981 103 p refs
(Contract W-7405-eng-26)
(ORNL/CSD-77) Avail: NTIS HC A06/MF A01

A simulation program is described for a latent heat storage subsystem whose purpose is to reduce the conventional air conditioning load of a house. Basic heat balances are given, some simulation results are shown, and broader questions regarding such a simulation are raised. DOE

N81-26584# Oak Ridge National Lab., Tenn. Engineering Technology Div.
NEW DIRECTIONS FOR DISTRICT HEATING IN THE UNITED STATES
M. Olszewski and M. A. Karnitz 1981 13 p Presented at the 1st Intern. Energy Agency (IEA) Conf. on New Energy Conserv. Technol. and Their Commercialization, Berlin, 6 Apr. 1981
(Contract W-7405-eng-26)
(CONF-810423-3) Avail: NTIS HC A02/MF A01

A description is given of the status of major US district heating projects and the potential impact of the newly implemented US National District Heating plan. Five major district heating projects moving into the construction and demonstration phase are described. Although all have hot water distribution systems, a variety of heat sources are utilized. These include geothermal water, industrial reject heat, and utility cogeneration using coal-fired power plants. DOE

N81-26585# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
SOLAR ASSISTED HEAT PUMP RESEARCH AND DEVELOPMENT PROGRAM IN THE UNITED STATES
J. W. Andrews 1980 16 p refs Presented at the Performance of Heat Pump Systems Workshop, Aachen, West Germany, 8-9 May 1980; sponsored by the German Section International Solar Energy Society
(Contract DE-AC02-76CH-00016)
(BNL-27722; CONF-8005150-1) Avail: NTIS HC A01/MF A01

A review of the historical progress and current status of the solar assisted heat pump research and development, supported by the United States Department of Energy, is presented. Its focus is on the need for a better source of auxiliary or backup heat than the electric resistance which has generally been assumed in computer simulations of these systems. The two leading candidates are the use of the ground as an alternate heat source/sink or storage element (ground coupling) and the use of fossil fuel burned on site (the bivalent system). The United States program emphasized ground coupling. Much of the analytical work and heat pump development is applicable to bivalent systems, and some results of this work are discussed. DOE

N81-26586# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
HYDROTHERMAL ENERGY DEVELOPMENT PROJECTS
E. G. DiBello 1981 4 p refs
(Contract DE-AC07-76ID-01570)
(CONF-810315-7) Avail: NTIS HC A02/MF A01

The development of hydrothermal energy for direct heat applications is being accelerated by twenty-two demonstration projects that are funded on a cost sharing basis by the US Department of Energy, Division of Geothermal Energy. These projects are designed to demonstrate the technical and economic feasibility of the direct use of hydrothermal resources in the United States. Engineering and economic data for the projects are summarized. The data and experience being generated by these projects will serve as an important basis for future direct heat development. DOE

N81-26587# Pennsylvania State Univ., University Park. Materials Research Lab.
BLACK aSi:H SPUTTERED FILMS FOR PHOTOVOLTAIC SOLAR CELLS Final Technical Report, 15 May 1979 15 May 1980
R. Messier and I. S. T. Tsong 1980 50 p refs
(Contract DE-AC03-79ET-23038)
(DOE/ET-23038/4) Avail: NTIS HC A03/MF A01

The many interrelated deposition processes and film characteristics which govern sputter deposited a-Si:H film quality, were examined in detail. Films were systematically prepared in deposition paramater space, and were characterized by surface and internal microstructure, chemical reactivity and etchability, total elemental composition, H-bonding configuration, intrinsic mechanical stress, optical bandgap, and mean density. Films prepared at high P/sub T displayed a distinct columnar morphology with varying extent of intercolumn void or low density regions. Results are consistent with the general Structure Zone Model of physical vapor deposition upon which there are superimposed the chemical effects H2 reactive sputtering. DOE

N81-26588# Mound Lab., Miamisburg, Ohio.
OBSERVATIONS REGARDING MATERIALS AND SITE PREPARATION FOR SALT-GRADIENT SOLAR PONDS
M. J. Harris, D. E. Etter, and L. J. Wittenberg 1981 4 p refs
(Contract DE-AC04-76DP-00053)
(MLM-2812(OP); CONF-810509-2) Avail: NTIS HC A02/MF A01

Experiences gained during the past two years at the largest solar pond in the US are presented. Approximately one year after the pond was completed, the random failures of portions of the factory-fabricated seams in the plastic liner were detected. In addition, excessive corrosion was evident in the copper tube heat exchanger which was submerged in the pond. Recommendations are made regarding the preparation of a solar pond site and regarding the materials and their fabrication into pond liners and heat exchangers. DOE

N81-26589# Committee on Banking, Finance and Urban Affairs (U. S. House).
COMPACT CITIES: ENERGY SAVING STRATEGIES FOR

THE EIGHTIES
Jul. 1980 94 p refs
(PB81-152019) Avail: NTIS HC A05/MF A01 CSCL 10A

Focus is on energy-saving land use patterns: how to halt urban sprawl with its excessive energy consumption. Appropriate renewable energy sources and conservation incentives for cities are discussed. GRA

N81-26590# General Accounting Office, Washington, D. C.
FORMULATION OF US INTERNATIONAL ENERGY POLICIES Report to the Congress
30 Sep. 1980 123 p
(PB81-156051; ID-80-21) Avail: NTIS HC A06/MF A01 CSCL 10A

To find out how the United States develops international energy policy, GAO reviewed five major energy issues covering the period from early 1977 through 1979. The issues are: vulnerabilities to petroleum supply interruptions; long term national security strategy on imported oil prices; export of U.S. oil and gas production equipment and technology to the Soviety Union; World Bank initiatives to assist in financing oil and gas exploration and development in oil-importing developing countries; and the role of gas imports relative to the nation's future sources of gas. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N81-26591 Michigan State Univ., East Lansing.
UPPER ATMOSPHERIC CONTROLS, SURFACE CLIMATE, AND PHYTOGEOGRAPHICAL IMPLICATIONS IN THE WESTERN GREAT LAKES REGION Ph.D. Thesis
John Ausman Harrington, Jr. 1980 247 p
Avail: Univ. Microfilms Order No. 8112090

The linkage between atmospheric circulation, surface climate, and plant geographical distributions in the upper Middle West is investigated. Ecophysiological studies of the vegetation transition from tall grass praire in the south and west through a zone of deciduous forests to the mixed coniferous-deciduous forest in the northeast suggest that summer season moisture stress is the environmental parameter which limits the distribution of the major vegetation associations. The surface weather patterns and associated upper atmospheric wind flow for days when a gradient in plant moisture stress exists are identified. Estimates of potential evapotranspiration calculated on a daily basis are combined with precipitation receipts to measure plant moisture stress. It is demonstrated that modal patterns of upper atmospheric circulation are associated with surface moisture stress patterns coinciding with the vegetation transitions. It is implied that phytogeographic boundaries may be set by the gradual accumulation of a frequently occurring environmental stress pattern. Dissert. Abstr.

N81-26592 Cornell Univ., Ithaca, N. Y.
THE INFLUENCE OF HYDRODYNAMIC TRANSPORT ON PHYTOPLANKTON DYNAMICS IN HOMOGENEOUS LAKES Ph.D. Thesis
Jan-Tai Kuo 1981 180 p
Avail: Univ. Microfilms Order No. 8110910

A mathematical model is developed in which a hydrodynamic model is incorporated as a direct additional component of eutrophication analysis. A finite element, homogeneous lake circulation model is coupled to a finite segment water quality model having a different space scale. These models are applied to the Rochester embayment in Lake Ontario and to Saginaw Bay in Lake, Huron. The significance of space and time scales on the distribution of phytoplankton is examined. It is shown that a series of steady state calculations with a circulation model can be used to simulate the time-variable and seasonal phytoplankton variation in homogeneous lakes. As the length scale of interest decreases, the influence of hydrodynamic transport on the phytoplankton distribution becomes more significant when compared to the influence of general biochemical kinetics. The significance of model grid size for bays and lakes is analyzed. Dissert. Abstr.

N81-26593 Pittsburg Univ., Pa.
ENVIRONMENTAL NOISE MANAGEMENT: AN OPTIMIZATION APPROACH Ph.D. Thesis
Altaf Ahmed Memon 1980 199 p
Avail: Univ. Microfilms Order No. 8112703

A general nonlinear programming model having the objectives of minimizing the total cost was presented for noise management system. The coefficients of exponential noise reduction cost functions were developed by regression analysis and a penalty function method was used to solve the nonlinear programming model. By substitution and mathematical approximation, the model was transformed into a geometric programming model. A computer program based on condensation technique was developed to solve geometric programming model. Therefore, two additional alternative solution methods are presented. The models consider noise reduction at source, along propagation path and at receiver locations. The utility of the model to determine the optimal strategy of noise reduction, modification and protection in terms of total costs is shown. An extension of the above models was made to include line noise sources. The utility of such models in urban noise management for surface transportation is also shown. Dissert. Abstr.

N81-26594*# Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences.
DATA REDUCTION ANALYSIS AND APPLICATION TECHNIQUE DEVELOPMENT FOR ATMOSPHERIC TRACE GAS CONSTITUENTS DERIVED FROM REMOTE SENSORS ON SATELLITE OR AIRBORNE PLATFORMS Final Report, period ending 30 Jun. 1980
Joseph C. Casas and Shirley A. Campbell May 1981 87 p refs
(Grant NsG-1395)
(NASA-CR-164478; GSTR-81-7) Avail: NTIS HC A05/MF A01 CSCL 13B

The applicability of the gas filter correlation radiometer (GFCR) to the measurement of tropospheric carbon monoxide gas was investigated. An assessment of the GFRC measurement system to a regional measurement program was conducted through extensive aircraft flight-testing of several versions of the GFRC. Investigative work in the following areas is described: flight test planning and coordination, acquisition of verifying CO measurements, determination and acquisition of supporting meteorological data requirements, and development of supporting computational software. T.M.

N81-26595*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF TYPE OF EXPLOSIVES AND PHYSICAL-MECHANICAL PROPERTIES OF EXPLOSIVE ROCK ON FORMATION OF TOXIC GASES IN ATMOSPHERE OF SHAFTS
E. O. Mindeli and M. Ya. Khudyakov Feb. 1981 8 p refs Transl. into ENGLISH from Vzryvnoye Delo (USSR), no. 72, 1973 p 147-150 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76549) Avail: NTIS HC A02/MF A01 CSCL 13B

The quality of toxic gases formed during explosive work in underground shafts depends upon the type of explosives and the conditions of explosion. Several types of explosives and rocks were examined. All remaining conditions were maintained the same (sandy-argillaceous stemming, electrical method of explosions, diameter of blast holes, and the direct triggering of charges). T.M.

N81-26596# Environmental Protection Agency, Las Vegas, Nev. Environmental Monitoring Systems Lab.
INTERIM GUIDANCE FOR VISIBILITY MONITORING Final Report
Nov. 1980 73 p refs
(PB81-157760; EPA-450/2-80-082) Avail: NTIS HC A04/MF A01 CSCL 13B

Information available regarding visibility monitoring methods presently in use is summarized. Measures for interim visibility monitoring are recommended. GRA

N81-26597# Argonne National Lab., Ill.
STUDIES ON MATHEMATICAL MODELS FOR CHARACTERIZING PLUME AND DRIFT BEHAVIOR FROM COOLING TOWERS. EXECUTIVE SUMMARY
Anthony Policastro, William Dunn (Illinois Univ., Urbana), and Richard Carhart (Illinois Univ., Chicago Circle) Apr. 1981 15 p refs Sponsored by Electric Power Research Inst.
(Contract W-31-109-eng-38; EPRI Proj 906-1)
(EPRI-CS-1683-SY) Avail: NTIS HC A02/MF A01

Models are developed for predicting plume rise and drift deposition from single and multiple natural draft and mechanical draft cooling towers. DOE

N81-26598# Battelle Pacific Northwest Labs., Richland, Wash.
LONG TERM EROSION RESISTANCE OF UNPROTECTED RADON SUPPRESSION EARTH COVERS TO WIND STRESSES
Thomas J. Bander Oct. 1980 10 p refs Presented at the 3rd Ann. Symp. on Uranium Mill Tailings Management, Fort Collins, Colo., 24-25 Nov. 1980 Submitted for publication
(Contract DE-AC06-76RL-01830)
(PNL-SA-9018; CONF-801155-2) Avail: NTIS HC A02/MF A01

Estimates of the amount of soil cover lost due to wind erosion are obtained using three different models. One model employs a wind erosion equation which is based on wind tunnel and agricultural field measurements. The second model is based on an analytical solution of the saltation process. The third model is based on a modification of the horizontal flux equation used by Bagnold and Chepil. Basic differences between the models are examined and a comparison of the soil movement predicted by each is presented. The usefulness of these wind erosion models as guidance in designing term erosion resistant covers for tailings piles is considered. DOE

N81-26599# Oak Ridge National Lab., Tenn. Information Div.
DEPARTMENT OF ENERGY FOSSIL ENERGY ENVIRONMENTAL COMPLIANCE PROGRAM HANDBOOK: FEDERAL REGULATIONS ON WASTE DISPOSAL
J. Huffstetler, Bobbie Neal Collier, Kathy Brown (Tennessee Univ., Knoxville), and Nelda McAfee (Tennesse Univ., Knoxville) Feb. 1981 373 p refs
(Contract W-7405-eng-26)
(ORNL/EIS-175) Avail: NTIS HC A16/MF A01

The US Department of Energy (DOE) is conducting a research, development, and demonstration program to provide technology that will permit rapid commercialization of processes for converting coal into synthetic fuels. This handbook identifies those federal laws and regulations on management of waste disposal that could affect the siting, construction, or operation of a conversion facility. All entries are part of a computerized data base built and maintained for the DOE at Oak Ridge National Laboratory. DOE

N81-26600# Oak Ridge National Lab., Tenn. Environmental Sciences Div.
METHODS FOR ECOLOGICAL TOXICOLOGY: A CRITICAL REVIEW OF LABORATORY MULTISPECIES TESTS
Anna S. Hammons, ed., J. M. Giddings, G. W. Suter, II, and L. W. Barnthouse Feb. 1981 320 p refs
(Contract W-7405-eng-26)
(ORNL-5708; EPA-560/11-80-026; Pub-1710) Avail: NTIS HC A14/MF A01

An evaluation is presented of selected laboratory methods for measuring ecological effects, and tests considered most suitable for research and development are recommended for use in predicting the effects of chemical substances on interspecific interactions and ecosystem properties. The role of mathematical models in chemical hazard assessment is also discussed. The criteria used for these evaluations include whether or not the tests are rapid, reproducible, relatively inexpensive, unequivocal, sensitive, socially relevant, predictive, generalizable, and well developed. DOE

N81-26601# Argonne National Lab., Ill. Center for Transportation Research.
ENVIRONMENTAL DEVELOPMENT PLAN FOR TRANSPORTATION PROGRAMS: FY80 UPDATE
C. L. Saricks, M. K. Singh, M. J. Bernard, III, and O. M. Bevilacqua Sep. 1980 139 p refs
(Contract W-31-109-eng-38)
(ANL/CNSV-TM/49) Avail: NTIS HC A07/MF A01

The ecosystem, resource, physical environment, health, safety, socioeconomic, and environmental control concerns associated with DOE programs are identified. The programs include the research, development, demonstration, and assessment of 14 transportation technologies and several strategy implementation projects. A research and assessment plan for resolving any potentially adverse environmental concerns arising from these programs is presented. DOE

N81-26602# Institute of Gas Technology, Chicago, Ill.
ENVIRONMENTAL ASSESSMENT OF THE HYGAS PROCESS. VOLUME 3: HYGAS ENVIRONMENTAL CHARACTERIZATION: MANUAL OF METHODS FOR CHARACTERIZATION OF HYGAS PILOT PLANT SOLIDS, LIQUIDS, AND GASES Interim Report
Richard H. Karst, Joseph L. Passaniti, Teresa C. Metcalf, Elsa V. Salazar, and Jimmy C. Pau Nov. 1980 126 p refs
(Contract EX-76-C-01-2433; Proj. 61014)
(FE-2433-26) Avail: NTIS HC A07/MF A01

The various analytical techniques used to analyze pilot plant streams for environmental species are described. Analytical techniques for the determination of the following are included: ammonia-nitrogen, biochemical oxygen demand, chemical oxygen demand, chlorides, total cyanide, grease and oil, total organic carbon, phenol, total suspended, and dissolved solids, sulfide, total sulfur, thiocyanate, total oxygen demand, hydrocyanic acid in gas, hydrogen sulfide in gas, gaseous hydrocarbons, organic compounds in HYGAS light oil and aqueous samples, proximate analysis of coal, ultimate analysis of coal, calorific value, screen analysis, bulk density, and trace elements in coal. DOE

N81-26603# Brookhaven National Lab., Upton, N. Y.
ACIDIC PRECIPITATION: CONSIDERATIONS FOR AN AIR-QUALITY STANDARD
L. S. Evans, George R. Hendrey, Gary J. Stensland (Illinois State Water Survey, Urbana), Dale W. Johnson (Oak Ridge National Lab., Tenn.), and A. J. Francis 1980 48 p refs Presented at the Air Pollution Assoc. Specialty Meeting: The Proposed SO sub x and Particulate Standards, Atlanta, 16-18 Sep. 1980
(Contracts DE-AC02-76CH-00016; W-7405-eng-26)
(BNL-29031) Avail: NTIS HC A03/MF A01

Acidic precipitation is a significant air pollution problem in the United States. The chief anions accounting for the hydrogen ions in rainfall are nitrate and sulfate. Agricultural systems are more likely to derive net nutritional benefits from increasing inputs of acidic rain than are forest systems when soils alone are considered. Acidification of fresh waters of southern Scandinavia, southwestern Scotland, southeastern Canada, and northeastern United States is caused by acid deposition. DOE

N81-26604# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Chemistry.
NITROGEN OXIDES CONTROVERSY
Harold S. Johnston Jan. 1981 35 p refs Presented at the Symp. on the SST Controversy Ten Years Later: A Case Study in the Use of Science for Decision Making, Toronto, Jan. 1981; sponsored by the American Association for the Advancement of Science
(Contract W-7405-eng-48)
(LBL-12251; CONF-810130-1) Avail: NTIS HC A03/MF A01

The scientific considerations that entered discussions of possible changes of stratospheric ozone by large fleets of US type SSTs are seen to be logical and constructive. Since 1961, it was realized that the photochemistry of the natural ozone balance cannot be explained in terms of pure oxygen species (O/sub x/ = O, O2, O3) but that something else in the stratosphere destroys most of the ozone formed at and below the altitude of its maximum mixing ratio. When (1965-70) this natural ozone destruction was thought to be caused by a few ppM of water, it was pointed out that the predicted 10% increase in stratospheric water by SSTs was a matter of concern. When (1970-71) it was found that a few ppB of nitrogen oxides (NO/sub

x/ = NO, NO2) probably are the major cause of natural ozone destruction, then it was pointed out that the predicted doubling of stratospheric NO/sub x/ by SSTs was a matter of concern. These were valid statements of the need for an environmental impact assessment. DOE

N81-26605# Southwest Research Inst., San Antonio, Tex.
CHARACTERIZATION OF EMISSIONS FROM MOTOR VEHICLES DESIGNED FOR LOW NOx EMISSIONS Final Report, Mar. 1977 - Jun. 1980
Lawrence R. Smith Aug. 1980 545 p refs
(Contract EPA-68-02-2497)
(PB81-155327; EPA-600/2-80-176) Avail: NTIS HC A23/MF A01 CSCL 13B

All of the vehicles had three-way catalysts, three with feedback carburetors and exhaust gas recirculation, and two with oxidation catalysts following the three-way catalysts. The emission rates of several unregulated pollutants including aldehydes, organic amines, sulfur dioxide, nitrous oxide, several individual hydrocarbons (including benzene), hydrogen sulfide, cyanide, organic sulfides, nickel carbonyl, ammonia, sulfate, trace metals, and N-nitrosodimenthylamine were determined. Additionally, the emission rates of the regulated pollutants, total hydrocarbons, carbon monoxide, and oxides of nitrogen were determined along with carbon dioxide and oxygen. GRA

N81-26606# Alaska Univ., Fairbanks. Inst. of Water Resources.
ICE FOG ABATEMENT AND POLLUTION REDUCTION AT A SUBARCTIC COAL-FIRED HEATING PLANT Final Report
L. E. Leonard, R. Seifert, J. Zarling, and R. Johnson Feb. 1981 75 p refs
(Grant EPA-R-804833)
(PB81-159113; EPA-600/3-81-020) Avail: NTIS HC A04/MF A01 CSCL 13B

An experimental cooler-condenser system was constructed at the coal-fired heating and electric plant. Flue gas was diverted from the existing power plant stack through the experimental system for test purposes. A cold water spray was directed into the muzzle of the experimental stack counter-current to the direction of flue gas flow to cool the gas, condense combustion-produced water vapor and scrub the gas stream of potential pollutants before they were released to the atmosphere. The system proved ineffective for its main function of ice fog reduction. GRA

N81-26607# California Univ., Riverside. Statewide Air Pollution Research Center.
GEOGRAPHICAL AND TEMPORAL DISTRIBUTION OF ATMOSPHERIC MUTAGENS IN CALIFORNIA Final Report, 27 Jun. 1978 - 26 Sep. 1979
James N. Pitts, Jr., William L. Belser, Jr., Richard D. Bliss, George J. Doyle, and Dennis R. Fitz May 1980 95 p refs
(Contract ARB-A7-138-30)
(PB81-158263; ARB-R-80/132) Avail: NTIS HC A05/MF A01 CSCL 13B

An assessment was made of the mutagenic potency, as determined by the AMES Salmonella mutagenicity assay, of suspended particulate matter in the South Coast Air Basin (SCAB) of Southern California. Airborne mutagen density ranged from 8 to 45 revertants/cu m in the absence of metabolic activation, and from 10 to 62 revertants/cu m with metabolic activation. No correlation was apparent between the air quality and meteorological data obtained at each sampling site and the measured mutagenicities although the impacts of traffic density, industrial emissions and transport phenomena appeared to be reflected in the data. GRA

N81-26608# Maryland Univ., College Park.
HALOCARBON PRODUCTION FROM OXIDATIVE BIOCIDES IN ESTUARINE WATERS Final Report, 1 Aug. 1975 - 31 Jul. 1977
George R. Helz, Rong Yew Hsu Hsu, and Richard Sugum Feb. 1981 44 p refs
(Grant EPA-R-803839)
(PB81-157927; EPA-600/3-81-010) Avail: NTIS HC A03/MF A01 CSCL 13B

Haloforms are readily generated in the laboratory with chlorine doses of 1 to 10 mg/l, the range employed by many coastal power plants. At salinities above 1 g/kg, Br is the principal halogen in the haloform products. On a molar basis, more than 4 percent of the chlorine was converted to haloforms in some tests. Ozone in the laboratory also generated haloforms in estuarine water; the yields were similar to those obtained from chlorine. However, only traces of haloforms were found in a power plant field site, where apparently haloform bypassing reactions consume free chlorine much faster than in the laboratory. Identification of these reactions is uncertain, but they may involve formation of stable halogenated macromolecules. GRA

N81-26609# Environmental Protection Agency, Ann Arbor, Mich. Emission Control Technology Div.
MOBILE SOURCE EMISSION INVENTORY
Mark Wolcott Dec. 1980 59 p
(PB81-167538; EPA-AA-TEB-81-11) Avail: NTIS HC A04/MF A01 CSCL 13B

Both current (1977) and future (up to 2005) year inventories are estimated. Eighteen different types of mobile sources are considered to ascertain the contribution of unregulated as well as presently regulated sources. Virtually all counties in the United States and its territories are included for one portion of the analysis. The majority of the analyses include only those counties that have the potential to violate the National Ambient Air Quality Standard (NAAQS) for carbon monoxide (CO), ozone (O3) or nitrogen oxides (NOx). GRA

N81-26610# Mason and Hanger-Silas Mason Co., Inc., Leonardo, N. J.
SUMMARY OF US ENVIRONMENTAL PROTECTION AGENCY'S OHMSETT TESTNG, 1974-1979 Final Report
Gary F. Smith Feb. 1981 365 p
(Contract EPA-68-03-2642)
(PB81-163743; EPA-600/9-81-007) Avail: NTIS HC A16/MF A01 CSCL 13B

Research to evaluatie and improve the ability to respond effectively to spills of floating oil and hazardous materials was performed at the test facility since August 1974. Over 84 devices were tested under 37 research programs. Results of tests on commercial, prototype, and model devices designed to control, contain, recover, detect, or measure floating oil and hazardous material spills are described. Research into oil weathering, environmental monitoring, spill behavior and chemical treating agents are discussed. GRA

N81-26611# Systems Applications, Inc., San Rafael, Calif.
USER'S MANUAL FOR THE PLUME VISIBILITY MODEL (PLUVUE) Final Report
Clark D. Johnson, Douglas A. Latimer, Robert W. Bergstrom, and Henry Hogo Nov. 1980 423 p refs
(Contract EPA-68-02-0337)
(PB81-163297; EPA-450/4-80-032) Avail: NTIS HC A18/MF A01 CSCL 13B

The model is designed to predict the impacts of a single emissions source on visibility in Federal Class 1 areas. The objective of the model is to calculate visual range reduction and atmospheric discoloration caused by plumes consisting of primary particulates, nitrogen oxides and sulfur oxides. The model uses the Gaussian equation for transport and dispersion. The spectral radiance is calculated for views with and without the plume to calculate other parameters related to perceptibility and contrast reduction. Plume optics calculations are made for two modes, plume-based and observer-based. GRA

N81-26612# United States of America National Committee for the International Association on Water Pollution Research.
DEVELOPMENTS AT TENTH INTERNATIONAL CONFERENCE ON WATER POLLUTION RESEARCH
Feb. 1981 264 p refs Conf. held at Toronto, 23-27 Jun. 1980
(Grant EPA-R-807269)
(PB81-161986; EPA-600/9-81-012) Avail: NTIS HC A12/MF A01 CSCL 13B

Modelling of lakes, pathogen removal, eutrophication, land disposal, methane fermentation, water-quality modelling and management, urban runoff, and gas transfer were discussed.

Sludge treatment, toxic materials, biological wastewater treatment, nitrogen and phosphorus removal, physical chemical treatment, water reuse, groundwater, and ocean disposal were summarized. GRA

N81-26613# Arizona Univ., Tucson.
RESEARCH NEEDS IN MODELING AND DATA INTERACTIONS AS RELATED TO GOVERNMENT WATER RESOURCES PROGRAMS Final Report
David R. Dawdy (Dames and Moore) and Thomas Maddock, III Oct. 1980 55 p refs
(Contract DI-14-34-0001-9629)
(PB81-161002; W81-01429; OWRT-C-90293-T(9629)(1)) Avail: NTIS HC A04/MF A01 CSCL 13B

Four research areas were examined as they relate to three topics, groundwater, surface water, and, to a minor extent, water quality; since the problems and models for each of the three topics raise different questions. The reseach areas examined were: assessment of problems facing water resources managers; describing how models fit into programs developed to solve water resources problems; assessing how well models fit program objectives; and assessing data requirements for the models.GRA

N81-26614# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
EMISSION INVENTORY REQUIREMENTS FOR 1982 OZONE STATE IMPLEMENTATION PLANS Final Report
Dec. 1980 41 p refs
(PB81-160434; EPA-450/4-80-016) Avail: NTIS HC A03/MF A01 CSCL 13B

The requirements are for those States which requested and have been granted an extension beyond July 1982 of an attainment date for the National Ambient Air Quality Standard (NAAQS) for ozone. Emission inventory requirements relating to geographic area of coverage, point source cutoff size specifications, pollutants of interest, data reporting formats, documentation requirements, quality of data base, years to be addressed, and specific inventory techniques to be employed are addressed. GRA

N81-26615# Schwartz and Connolly, Inc., Washington, D.C.
AUTOMOBILE EMISSION IMPACTS OF GASOHOL USE
Jeffrey H. Schwartz, Stephen J. Connolly, E. Joseph Duckett, Alexis J. Hoskins, and Katharine W. Kimball Oct. 1980 107 p refs Sponsored by National Alcohol Fuels Commission
(PB81-159394; NAFC-80-21) Avail: NTIS HC A06/MF A01 CSCL 13B

Control options for evaporative emissions were examined in great detail. No major emission increases or decreases are foreseen as gasohol use increases. Any increases in ambient fuels of ozone (primarily due to increased evaporative hydrocarbon emissions with gasohol) are likely to be very small and develop gradually over the next 5-7 years. If these increases do occur, they are likely to be of concern only to those few regions still out of compliance with ambient ozone standards. The evidence to data suggests that gasohol marketing can continue without endangering public health and welfare. Policy options are explored for eliminating regulatory uncertainty surrounding this issue. GRA

N81-26616# Argonne National Lab., Ill. Div. of Environmental Impact Studies.
HANDLING OF COMBUSTION AND EMISSION-ABATEMENT WASTES FROM COAL-FIRED POWER PLANTS: IMPLICATIONS FOR FISH AND WILDLIFE RESOURCES
Lars R. Soholt, Robert W. Vocke, N. J. Beskid, W. K. Derickson, M. J. Knight, D. D. Ness, B. Siskind, W. S. White, and D. J. Wyman, ed. Sep. 1980 191 p refs Prepared for Fish and Wildlife Service and EPA
(Contract W-31-109-eng-38)
(PB81-158917; FWS/OBS-80/33) Avail: NTIS HC A09/MF A01 CSCL 13B

Increased emphasis upon using coal as an energy source and the concomitant requirements for flue gas emission control have led to increased production of solid wastes, which is expected to accelerate over the next several decades. A basic introduction to handling of wastes from coal combustion and emission abatement, which may prove toxic if released in sufficient quantity, is presented. A procedure for evaluating the potential for these wastes to impact fish and wildlife resources is outlined. GRA

N81-26617# Engelhard Minerals and Chemicals Corp., Union, N. J.
CATALYTIC INCINERATION OF LOW CONCENTRATION ORGANIC VAPORS Final Report, Oct. 1978 - May 1980
Norman A. Martin Feb. 1981 79 p refs
(Contract EPA-68-02-3133)
(PB81-158446; EPA-600/2-81-017; IERL-RTP-1135) Avail: NTIS HC A05/MF A01 CSCL 13B

The catalytic abatement of low concentration hydrocarbon vapors on both a pilot and full scale system was examined. The tests were conducted on industrial exhausts containing CO and volatile hydrocarbons. An economic comparison was made between thermal and catalytic abatement systems, utilizing this data. The pilot scale data was obtained over a 5 month period from a plastic printing plant where the major solvents were ethanol, n-propyl acetate, and heptane. The full scale data was obtained over a 9 month period from a Formox (Reichold Chemical Co.) formaldehyde plant exhaust containing CO, dimethyl ether, methanol, and formaldehyde. The pilot and full scale units were able to convert 97-99 percent of the pollutants to CO2 and water. GRA

N81-26618# Resource Planning Associates, Inc., Washington, D. C.
SOURCE SEPARATION COLLECTION AND PROCESSING EQUIPMENT Final Report
Larry Oliva, Janice Huffman, and Jerry Powell 24 Jul. 1980 97 p Sponsored by EPA
(PB81-158297; EPA-530/SW-192C) Avail: NTIS HC A05/MF A01 CSCL 13B

Detailed descriptions of equipment, examples of its uses, including cities where the equipment is used, and specific recommendations on equipment design and use are presented. The research effort behind the user's guide is summarized and copies of important research tools are provided. GRA

N81-26619# Systems Applications, Inc., San Rafael, Calif.
WORKBOOK FOR ESTIMATING VISIBILITY IMPAIRMENT
Douglas A. Latimer and Robert G. Ireson Nov. 1980 392 p refs
(Contract EPA-68-02-0337)
(PB81-157885; EPA-450/4-80-031) HC A17/MF A01 CSCL 13B

Three screening procedures designed to assist in determining the potential impacts of an emissions source on a Federal Class I area's visibility are presented. A level-1 analysis involves a series of conservative screening tests to eliminate sources with little potential for visibility impairment during hypothetical worst case meteorological conditions. If impairment is indicated, a more resource intensive level-2 analysis is warranted. If both analyses indicate impairment, a level-3 analysis using a plume visibility model is used. Two example applications are provided; for a coal-fired power plant and a cement plant. GRA

N81-26620# Versar, Inc., Springfield, Va.
ANALYSIS SYSTEM FOR TOTAL SULFURIC ACID IN AMBIENT AIR. DEVELOPMENT AND PRELIMINARY EVALUATION Final Report, 30 Sep. 1976 - 17 Apr. 1980
James D. Barden Feb. 1981 69 p
(Contract EPA-68-02-2465)
(PB81-159139; EPA-600/2-81-013) Avail: NTIS HC A04/MF A01 CSCL 07D

A total sulfuric acid analysis (TSAA) system was developed and shown to provide quantitative determinations of sulfuric acid in air at concentrations as low as 0.26 micrograms/cu m. Quantitation at lower concentrations appears to be possible. The general approach in the design and development effort emphasized sample conditioning, rather than detector selectivity, to provide unambiguous detection. Separation of the acid from other sample components was accomplished by stagewise condensation and revaporization; therefore, particulate filters were not required. Effects of major potential interferences (SO2, NH3, and

ammonium sulfates) apparently were eliminated by the addition of a small amount of hydrogen chloride to the sample. GRA

N81-26621# California Univ., Berkeley. Lawrence Berkeley Lab.
AEROSOL ANALYSIS FOR THE REGIONAL AIR POLLUTION STUDY Final Report
J. M. Jaklevic, R. C. Gatti, F. S. Goulding, B. W. Loo, and A. C. Thompson Feb. 1981 54 p refs
(Contracts EPA-79-D-X0712; EPA-IAG-D6-0670)
(PB81-157141; EPA-600/4-81-006) Avail: NTIS HC A04/MF A01 CSCL 07D

Beginning in May 1975 and continuing through April 1977, a total of 35,000 individual ambient aerosol samples were collected at ten selected sampling sites in St. Louis, as part of the Regional Air pollution Study (RAPS). Mass concentrations were determined by a beta particle attenuation method. This required measurement of tare weights for each individual filter before being sent to the field sites and subsequent measurement on their return. Elemental analysis of the particulate samples was performed for 27 elements using energy dispersive X-ray fluorescence analysis. Optimal sensitivities were obtained using pulsed excitation, and automated data handling was employed to facilitate the 35,000 data sets. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N81-26622 Wisconsin Univ. - Madison.
A DIAGNOSTIC STUDY OF THE ZONALLY-AVERAGED GLOBAL CIRCULATION IN ISENTROPIC COORDINATES Ph.D. Thesis
Ronald Dean Townsend 1980 248 p
Avail: Univ. Microfilms Order No. 8106533

The forcing and maintenance of the zonally-averaged global circulation was investigated in both isobaric and isentropic coordinates through transport diagnostics of mass, angular momentum, and energy. The mass circulations consist primarily of direct Hadley cells in low latitudes and indirect Ferrel cells in midlatitudes of both hemispheres. Transport by the ageostrophic mean mode in tropical latitudes and by the transient and standing eddy modes in extratropical latitudes maintains the angular momentum and energy balance requirements of the general circulation. It is shown that the isobaric and isentropic perspective of the forcing and maintenance of the circumpolar vortex is coordinate dependent. The baroclinic waves and embedded extratropical cyclones are the fundamental transport mechanism of midlatitudes. In isobaric coordinates the baroclinic waves contribute primarily to an eddy mode of angular momentum and energy transport. The baroclinic wave structure provides both a mean and an eddy mode of angular momentum transport and yields a dominant geostrophic mean mode of energy transport in isentropic coordinates. Dissert. Abstr.

N81-26623 Brown Univ., Providence, R. I.
THE ROLE OF PLANETARY VARIABLES IN IMPACT CRATERING PROCESSES Ph.D. Thesis
Mark John Cintala 1980 209 p
Avail: Univ. Microfilms Order No. 8111086

The effects of planetary variables on impact cratering phenomena were explored. The following major points are summarized: (1) statistical studies indicate that the interior morphologies of lunar and mercurian craters are strongly influenced by the terrain in which the craters were formed; (2) rim heights of mercurian craters are greater than those of their lunar counterparts; (3) when compared to those of the Moon and Mercury, fresh Martian craters are shallower, the break in slope in a logarithmic plot of depth vs diameter occurs at a smaller diameter, and the slope of the distribution above the inflection point is greater than those of the other two planets; and (4) theoretical calculations of basalt and H2O ice target heating during impact events indicate that a larger volume of H2O ice would be melted and/or vaporized by an impact of equal magnitude. It is also shown that at relatively low impact velocities, projectiles colliding with comet nuclei would probably suffer minimal damage while penetrating to many multiples of their own length and the cratering process on small asteroids and satellites differs in some respects from that on large planets. The substantial curvatures and weak surface gravities of these bodies affect ejecta dynamics and trajectories, and their small dimensions encourage violent stresswave induced ground motions. Dissert. Abstr.

N81-26624 California Univ., San Diego.
SEISMOTECTONIC STUDIES IN THE PACIFIC OCEAN BASIN Ph.D. Thesis
Keith Allen Sverdrup 1981 459 p
Avail: Univ. Microfilms Order No. 8111899

Results of three seismotectonic studies in the Pacific are discussed. The 15-station French Polynesian Network is used to study intraplate seismicity for the period 1965-1979. Activity clusters at 65 localities, generally uncorrelated with major bathymetric features. Three localities were the sites of two or more events of body-wave magnitude greater than 5.0. Regions A, B, and C; improved methods for single-event and multiple-event hypocenter determination are developed and applied to these earthquakes. An analysis of water multiples indicates hypocentral depths within the oceanic crust. Eight focal mechanisms have nearly horizontal compressional axes roughly in the direction of plate motion suggesting the presence of a regional stress field possibly due to the so-called ridge-push force. Dissert. Abstr.

N81-26625 California Univ., Los Angeles.
EVOLUTIONARY SPECTRA FOR STRONG MOTION BODY AND SURFACE WAVES Ph.D. Thesis
George Ching-Chi Liang 1980 454 p
Avail: Univ. Microfilms Order No. 8111248

The nonstationary characteristic of strong motion accelerograms is one of the most important ingredients for the generation of design earthquake motion. The various influences which contribute to the nonstationarity were examined. The examination of the nonstationarity made use of the evolutionary spectrum. The evolutionary spectrum describes the accelerogram in the form of Fourier amplitude versus time and frequency. It provided a clear description of the nonstationarity of the accelerogram and it also allowed the various body and surface wave trains in the accelerogram to be identified. The identification of the wave components using the evolutionary spectrum allowed the nonstationary characteristics of the strong motion accelerogram to be directly related to the behavior of the seismic waves. The Thomson-Haskell model provided the theoretical verification for the wave components identified by the evolutionary spectrum. Dissert. Abstr.

N81-26626 City Univ. of New York, N. Y.
SEISMIC ANALYSIS OF STRUCTURES EMBEDDED IN SATURATED SOILS Ph.D. Thesis
Richard Hai Lung 1981 283 p
Avail: Univ. Microfilms Order No. 8112759

The influence of pore water on the dynamic soil-structure interaction process was studied. The equations of motion of the two phase soil/water system are presented and the corresponding finite element analogy were developed. Numerical results were generated to determine the influence of pore water on the dynamic compliance coefficients typically used for seismic interaction studies. The results indicate that pore water significantly influences both the magnitude and character of these coefficients. Dissert. Abstr.

N81-26627 Brown Univ., Providence, R. I.
A STUDY OF THE BREAKDOWN OF STATICALLY GENERATED INTERNAL GRAVITY WAVES IN A STRATIFIED SHEAR FLOW WITH A MEAN VELOCITY Ph.D. Thesis
Michael Robert Muller 1980 304 p
Avail: Univ. Microfilms Order No. 8111152

The breakdown of the internal gravity waves by the growth frequency unstable waves of the Kelvin-Helmholtz type, either on the front face or the back face of the primary internal wave, is shown. Using phase averaging techniques, based on the frequency of the primary internal gravity waves, data gathered

at many different vertical locations were combined to create interface maps of the temperature and the two velocity components which provided detailed pictures of the deflection of the interface and the corresponding perturbation velocity field. The interface maps show that the position of the fastest growing high frequency oscillations occured at the point where the local minimum Richardson number was the smallest. Also, the appearance of the high frequency oscillations in the phase averaged interface maps indicated that the position of the unstable waves on the primary wave was not random. Dissert. Abstr.

N81-26628# Danish Meteorological Inst., Copenhagen.
RUDE SKOV GEOPHYSICAL OBSERVATORY: MAGNETIC RESULTS, 1979
1981 42 p refs
(ISBN-87-7478-187-1) Avail: NTIS HC A03/MF A01

The values of hourly means are based on photographic records from the following three variometers: an H variometer EH, a D variometer ED, both of the Edelmann type, and a Z variometer 250 of the type La Cour, a so called Godhavn balance. The three variometers recorded on three drums of an Edelmann normal rate recorder. Insensitive recordings of the three elements were obtained by a Mascart system, and a quick run recording by means of a La Cour system. T.M.

N81-26629# R and D Associates, Marina Del Rey, Calif.
A REVIEW OF DATA FOR ELECTRON MOBILITY, ENERGY, AND ATTACHMENT RELEVANT TO EMP AIR CHEMISTRY Topical Report, 27 Nov. 1978 - 31 Dec. 1979
M. K. Grover and F. R. Gilmore 1 Mar. 1980 38 p refs
(Contract DNA001-79-C-0011)
(AD-A098847; RDA-TR-110002-001; DNA-5457T) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report reviews the data for electron mobility, mean electron energy and electron attachment rate in moist air, for electric fields up to about 100,000 v/m.atm, corresponding to mean electron energies up to about 0.5 eV. It is found that recent mobility measurements and calculations based on published rate coefficients generally agree within about 20%. The percentage variations in the mean electron energies derived from various sources are larger, especially for moist air. However, in EMP problems the electron energy enters only as it influences the mobility or the attachment rate, which fact tends to reduce the effects of such uncertainties. The electron attachment rates calculated from various sets of data and also those measured very recently by Price and van Lint near 1 atm show a variety of discrepancies, but all results generally lie within + or - 40% of a mean curve. The data of McCorkle et al., and to some extent the data of van Lint and Price, suggest that at nitrogen partial pressures above about 0.3 atm the variation of attachment rate with electron energy changes somewhat from that observed at lower nitrogen pressures; however, the anomalies observed are neither well established nor understood at this time. The mobilities and attachment rates used in existing EMP codes generally lie within the uncertainty ranges of the best current data. Author (GRA)

N81-26630# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE, 6 JAN. - 3 MAY 1980
Robert P. Pagliarulo, John P. Turtle, John E. Rasmussen, Ralph E. Gifford, and Wayne I. Klemetti Oct. 1980 84 p refs Sponsored by AF
(AF Proj. 2305)
(AD-A098977; RADC-TR-80-298) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. Riometer and magnetometer measurements of the polar propagation environment are presented as supplementary data. Author (GRA)

N81-26631# Naval Research Lab., Washington, D. C.
DIFFUSION OF SMALL-SCALE DENSITY IRREGULARITIES DURING EQUATORIAL SPREAD F
J. D. Huba and S. L. Ossakow 28 May 1981 44 p refs
(RR0330244)
(AD-A099388; NRL-MR-4521) Avail: NTIS HC A03/MF A01 CSCL 04/1

The diffusion of small-scale density irregularities (i.e., those with density gradient scale lengths less than several hundred meters) is investigated during the decay phase of equatorial spread F. Both classical and anomalous diffusion processes are considered. The anomalous diffusion coefficient is based upon the transport properties associated with the universal drift instability. It is found that anomalous diffusion can smooth out small-scale density irregularities on time scales, tau, consistent with observational results, i.e., few minutes < or approx. = tau < or approx. = few hours. On the other hand, classical diffusion is much too slow a process to be important. However, anomalous diffusion is unable to diffuse large-scale irregularities, i.e., those with scale lengths greater than a kilometer, on the time scales tau < or approx. = few hours and another mechanism must occur to smooth out these irregularities, e.g., shorting out to the E region. Author (GRA)

N81-26632# Nebraska Univ., Omaha. Dept. of Physics.
ATMOSPHERIC ABSORPTION OF RADIATION BY WATER Final Scientific Report, 1 Feb. 1980 - 31 Jan. 1981
R. H. Tipping 31 Jan. 1981 10 p refs
(Grant AF-AFOSR-0058-80; AF Proj. 2310)
(AD-A098800; AFOSR-81-0410TR) Avail: NTIS HC A02/MF A01 CSCL 04/1

A quantum mechanical theory for the complete contour of allowed spectral lines has been formulated. Application of this theory with a realistic water potential will enable one to compute the absorption due to water far from the centers of the bands. This will permit a quantitative comparison with the experimental continuum measurements. Other possible mechanisms for the water continuum have been identified. One of these mechanisms, pressure induced absorption, has been shown to play an important role in the interpretation of laboratory spectra which are currently used as the basis for empirically modeling the water continuum. Author (GRA)

N81-26633# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE DIURNAL VARIATION OF TURBOPAUSE HEIGHT Environmental Research Papers, Interim Report
Samuel P. Zimmerman 3 Nov. 1980 12 p refs
(AF Proj. 6690)
(AD-A099340; AFGL-TR-80-0332; AFGL-ERP-716) Avail: NTIS HC A02/MF A01 CSCL 04/1

Utilizing chemical release observations, and recently reported turbopause heights based upon mass spectrometer measurements of the Ar/N2 ratio, the diurnal variability of turbopause height is determined. Separation of the data, on a seasonal basis, shows that there is a strong winter diurnal variability with turbulence carrying to its highest altitude (approximately 115 km) between sunset and midnight, and minimizing at the noon hour. The spring data shows a similar variability, but at an overall lower altitude than that of winter, and a possible latitudinal difference, while the fall results demonstrate no real diurnal variation, and an average turbopause height at approximately 106 km. Author (GRA)

N81-26634# Washington Univ., Seattle. Dept. of Electrical Engineering.
MULTIPLE SCATTERING EFFECTS ON TRANSMISSION THROUGH THE ATMOSPHERE Annual Summary Report, 1 Sep. 1980 - 31 Aug. 1981
Akira Ishimaru May 1981 7 p refs
(Contract N00014-78-C-0723)
(AD-A099235; TR-3-ONR) Avail: NTIS HC A02/MF A01 CSCL 20/6

A summary of the work completed and underway on the contract covering the period from September 1, 1980 to April 15, 1981 is given. The work is directed to the investigation of the transmission characteristics of optical waves with wavelengths in the range of 1-15 micron through various atmospheric conditions including clouds, fog, turbulence, rain, hail, snow, and inhomogeneous layers. Progress was made on the thorough understanding of plane wave transmission characteristics through fog. GRA

N81-26635# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.

ANALYSIS OF LUNAR LASER RANGING DATA AND PERFORMANCE AND ANALYSIS OF VLBI OBSERVATIONS FOR GEODETIC PURPOSES Final Report, 15 Feb. 1979 - 30 Sep. 1980

C. C. Counselman, III, T. A. Herring, R. B. Langley, and I. I. Shapiro 27 Nov. 1980 38 p refs

(Contract F19628-79-C-0064; AF Proj. 2039)

(AD-A098960; AFGL-TR-81-0004) Avail: NTIS HC A03/MF A01 CSCL 08/5

UT0 and variation of latitude have been determined from the McDonald Observatory lunar laser ranging (LLR) observations for the period October 1970 to October 1979. We have compared our estimates with those determined from the UT1 and pole position values obtained using other techniques. In 1978, the distance between the Haystack Observatory in the United States and the Onsala Space Observatory in Sweden was determined by very long baseline interferometry (VLBI) with the 'Mark-I' System; the estimated uncertainty was less than 10 cm. In 1979 and again in 1980, the distance between these observatories was redetermined with the 'Mark-III' VLBI System. On each occasion, transatlantic distances were also determined by VLBI between one or both of these observatories and various other sites in the U.S. and Europe. Preliminary solutions using the November 1979 experiment data have indicated that the Mark-I derived baseline lengths are consistent with the Mark-III values within the quoted 10 cm precision of the Mark-I values.

Author (GRA)

N81-26636# Boston Univ., Mass. Dept. of Astronomy.

THE RELATIONSHIP BETWEEN Pi2 OBSERVED AT MIDLATITUDES AND AT GEOSYNCHRONOUS ORBIT Final Report, 15 Dec. 1979 - 30 Nov. 1980

W. J. Hughes Hanscom AFB, Mass. AFGL 7 Jan. 1981 45 p refs

(Contract F19628-80-C-0025; AF Proj. 2311)

(AD-A098938; AFGL-TR-81-0005) Avail: NTIS HC A03/MF A01 CSCL 04/1

A study of substorm associated pi2 magnetic pulsations using data from the AFGL magnetometer network. A global study, using 40 ground stations and three spacecraft, of a few selected events demonstrates the global nature of the pi2 signature and suggests that day and nightside wave activity is sometimes closely related. Propagation delay times of the signal over many hours of local time were found to be immeasurably small (-30s) at midlatitudes (L about 3). A correlation of a month's data from two geostationary spacecraft (GOES 2 and GOES 3) with the AFGL magnetometer data shows that pi2 signals are more localized azimuthally in space at geostationary orbit, than they are on the ground at midlatitudes, where they usually extend further than the 4 hours local time span of the AFGL network. We also found that during quiet times (low K sub p) pi2's occur less often at geostationary orbit than on the ground. GRA

N81-26637# Army Cold Regions Test Center, Fort Greely, Ark.

HYPERBOLIC REFLECTIONS ON BEAUFORT SEA SEISMIC RECORDS

K. G. Neave, P. V. Sellmann, and A. Delaney Mar. 1981 23 p refs Sponsored in part by NOAA and U.S. Army

(Contract DI-01-5-022-2313)

(AD-A099171; CRREL-81-2) Avail: NTIS HC A02/MF A01 CSCL 20/1

Many hyperbolic reflections was observed on marine seismic records obtained during oil exploration in the Beaufort Sea, and on USGS seismic sub-bottom profiles from the Prudhoe Bay vicinity. A hyperbolic projection system was designed to rapidly measure seismic velocities from the curves on the records. The velocities observed were approximately the velocity of sound in water. The hyperbolic signals also showed dispersion properties similar to acoustic normal modes in shallow water. These observations indicate that the signals responsible for the hyperbolic reflections propagate as normal modes within the water layer, with very limited penetration of the seabed. Determinations of the dominant frequency of these signals indicate that the penetration into the seabed has a characteristic attenuation depth (skin depth) of about 1.5m for the sub-bottom profiles and 12 m for the marine records. It therefore appears that some hyperbolic reflections may be generated by variations in materials that occur near the seabed. GRA

N81-26638# HSS, Inc., Bedford, Mass.

EVALUATION, FEASIBILITY, AND DESIGN OF A THREE-WAVELENGTH INFRARED ATMOSPHERIC AEROSOL EXTINCTIOMETER Final Report, 9 Jul. 1979 - 8 Jun. 1980

D. F. Hansen, H. S. Stewart, C. C. Petty, and L. B. Woolaver 2 Sep. 1980 188 p refs

(Contract F19628-79-C-0132)

(AD-A099306; HSS-B-071; AFGL-TR-80-0323) Avail: NTIS HC A09/MF A01 CSCL 04/1

This design study represents the first phase of an AFGL program to develop an instrument for measuring the infrared extinction coefficient of atmospheric aerosols. The performance objectives of the instrument require that the instrument operate in all environments, perform measurements in three wavelength regions (1, 3-5, and 8-12 micrometers), and cover a range defined by 50 kilometer visibility at one extreme and fog at the other extreme. The initial phase of the study was devoted to a review of all known techniques for determining the extinction coefficient of atmospheric aerosols. The review led to the selection of an extinctiometer concept as the best possible approach to achieve the AFGL objectives, given the present technological state-of-the-art in all alternative candidate techniques. Finally, a conceptual design and an engineering design specification were prepared, based on a unique extinctiometer measurement technique.

Author (GRA)

N81-26639# Pennsylvania Dept. of Environmental Resources, Harrisburg. Bureau of Topographic and Geologic Survey.

STRATIGRAPHIC CROSS SECTION (J) OF THE UPPER DEVONIAN PERRYSBURG AND JAVA FORMATIONS AND THEIR EQUIVALENTS, NORTHWESTERN PENNSYLVANIA

J. A. Harper and K. D. Abel 1981 25 p refs

(Contract DE-AS21-76MC-05198)

(METC/EGSP-23) Avail: NTIS HC A02/MF A01

The cross section is based primarily on gamma ray logs with some supplemental sample control. Special emphasis is placed on the organic-rich, radioactive shales of these formations. Sample control is based primarily on interpretations of commercial sample logs (Geologs). T.M.

N81-26640 Texas Univ., Austin. Bureau of Economic Geology.

GEOLOGY AND GEOHYDROLOGY OF THE PALO DURO BASIN, TEXAS PANHANDLE. REPORT ON THE PROGRESS OF NUCLEAR WASTE ISOLATION FEASIBILITY STUDIES, 1979

T. C. Gustavson, M. W. Presley, C. R. Handford, R. J. Finley, S. P. Dutton, R. W. Baumgardner, Jr., K. A. McGillis, and W. W. Simpkins 1980 113 p refs

(Contract DE-AC97-79ET-44614)

(DOE/ET-44614/T2) Avail: NTIS HC A06/MF A01

The structural and stratigraphic framework of the basins were delineated. Data from 8000 ft (2400 m) of core material were integrated into salt-stratigraphy models. Salt depth and thickness were delineated for seven salt-bearing stratigraphic units. Ground and remotely sensed data were collected to describe surficial processes, including salt solution, slope retreat/erosion mechanisms, geomorphic evolution, and fracture system development. Both shallow and deep fluid circulation within the basins were evaluated. T.M.

N81-26641# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Civil Engineering.

PROBABILISTIC SEISMIC STABILITY ANALYSIS OF EARTH SLOPES

D. A. Grivas and J. D. Howland Dec. 1980 131 p refs

(Grant NSF ENV-77-16185)

(PB81-158883; NSF/RA-800385) Avail: NTIS HC A07/MF A01 CSCL 08M

A mathematical model is proposed for determining the reliability of earth slopes during earthquakes. The method provides a probabilistic, pseduo-static, seismic stability analysis. Safety of slopes is measured in terms of probability of failure rather than the customary safety factor, and the numerical values are determined via a Monte Carlo simulation of failure. Significant

uncertainties present in conventional methods of analysis are identified and probabilistic tools introduced for their description and amelioration. Models used to account for the variability of soil strength are described and illustrated. Results of a parametric study on the relative strength and seismic parameters are presented in graphs and tables. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-26642 Kansas Univ., Lawrence.
OCEANIC WIND VECTOR DETERMINATION USING SEASAT SATELLITE Ph.D. Thesis
George John Dome 1980 189 p
Avail: Univ. Microfilms Order No. 8111793

Geophysical modeling activities and algorithms developed for the SEASAT-I satellite prior to August 1979 are described. Models are presented to describe the wind vector (speed and directional) properties of the radar backscatter and to describe the measurement scene of a downward looking radiometer over the ocean when clouds and rain are present. Descriptions are given for algorithms to co-locate fore and aft beam SEASAT scatterometer measurements, to estimate the wind vector using orthogonal pairs of (SEASAT) radar scatterometer measurements, to co-locate SEASAT microwave scatterometer and radiometer measurements and to estimate the atmospheric corrections for (SEASAT) scatterometer due to absorption using microwave radiometer measurements. Dissert. Abstr.

N81-26643*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LIGHTNING ELECTRIC FIELD MEASUREMENTS WHICH CORRELATE WITH STRIKES TO THE NASA F-106B AIRCRAFT, 22 JULY 1980
D. M. LeVine May 1981 28 p refs
(NASA-TM-82142) Avail: NTIS HC A03/MF A01 CSCL 04B

Ground-based data collected on lightning monitoring equipment operated by Goddard Space Flight Center at Wallops Island, Virginia, during a storm being monitored by NASA's F-106B, are presented. The slow electric field change data and RF radiation data were collected at the times the lightning monitoring equipment on the aircraft was triggered. The timing of the ground-based events correlate well with events recorded on the aircraft and provide an indication of the type of flash with which the aircraft was involved. J.D.H.

N81-26644*# FWG Associates, Inc., Tullahoma, Tenn.
CHARGED PARTICLE CONCEPTS FOR FOG DISPERSION Final Report
Walter Frost, Frank G. Collins, and David Koepf Washington NASA Jun. 1981 122 p refs
(Contract NAS8-33541)
(NASA-CR-3440) Avail: NTIS HC A06/MF A01 CSCL 04B

Charged particle techniques hold promise for dispersing warm fog in the terminal area of commercial airports. This report focuses on features of the charged particle technique which require further study. The basic physical principles of the technique and the major verification experiments carried out in the past are described. The fundamentals of the nozzle operation are given. The nozzle characteristics and the theory of particle charging in the nozzle are discussed, including information from extensive literature on electrostatic precipitation relative to environmental pollution control and a description of some preliminary reported analyses on the jet characteristics and interaction with neighboring jets. The equation governing the transfer of water substances and of electrical charge is given together with a brief description of several semi-empirical, mathematical expressions necessary for the governing equations. The necessary ingredients of a field experiment to verify the system once a prototype is built are described. Author

N81-26645# European Space Agency, Paris (France).
SATELLITE METEOROLOGY OF THE MEDITERRANEAN
T. D. Guyenne, ed. and G. Levy, ed. Feb. 1981 320 p refs Partly in ENGLISH and FRENCH Proceedings of Intern. School of Meteorol. of the Mediterranean, Erice, Italy, 12-22 Nov. 1980; co-sponsored by Italian Ministry of Public Education, Italian Ministry of Science and Technology Research, CNR and Sicilian Regional Government Original contains color illustrations
(ESA-SP-159; ISSN-0379-6566) Avail: NTIS HC A14/MF A01

A course on Mediterranean meteorology, stressing the application of satellite soundings and observations, was given. The curriculum covers the accuracy and use of vertical soundings, interactive data processing methods, and the determination of winds from satellite data. The objective analysis of cloud fields is discussed, and the data requirements of radiation climatology are defined. Also explored are telecommunication missions for meteorological satellites as well as satellite data requirements for the Alpex experiment. A survey of Mediterranean weather variations during 1979 is included. For individual titles, see N81-26646 through N81-26674.

N81-26646# Aeronautica Militare Italiana, Rome.
ANALYSIS AND FORECASTING ON THE MEDITERRANEAN AREA: PROBLEMS AND OUTLOOK
L. LaValle *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 7-10 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Forecasting methods are assessed and their appropriateness to analysis and prediction for the Mediterranean area is discussed. The phenomenon is approached by considering the kinetic energy exchanges between motions of different size. An equation for the local change in the kinetic energy of an atmospheric layer is given. The standard deviation of the terms of the basic equation vertically integrated stresses the great relative importance of the dissipation due to small synoptic motions and subsynoptic motions. An indicative correspondance between time period and forecasting method is established. Results show that forecasts up to 12 hr gain little from numerical methods. Checking against climatology shows that numerical forecasts lose validity after 5 days. Statistical methods look promising. However, both future super models and present models require far more accurate initial conditions than those presently available. Author (ESA)

N81-26647# National Oceanic and Atmospheric Administration, Madison, Wis. National Earth Satellite Service.
REMOTE SOUNDING OF TEMPERATURE AND MOISTURE: CURRENT STATUS OF DATA CHARACTERICS, ACCURACY AND IMPACT ON WEATHER FORECASTING
C. M. Hayden and W. L. Smith *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 15-27 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

The characteristics of temperature and moisture sounding from the current generation of NOAA polar orbiting satellites are considered. Particular attention is given to a proper technique for statistical evaluation. It is stressed and supported by example that such evaluation does not elucidate important sources of retrieval error caused by surface effects. Methods of providing horizontal gradient information are presented with consideration of forecast impact. A feature of satellite sounding, short period time evolution in the weather, is demonstrated with overlapping orbits of the TIROS N and NOAA 6 satellites. Author (ESA)

N81-26648# Bologna Observatory (Italy). Ist. di Geofisica.
INVERSION OF AEROSOL OPTICAL DEPTH TO RECOVER SIZE SPECTRA
R. Rizzi *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 29-32 (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Two linear inverse methods for recovering aerosol size spectra from optical depths are compared. A synthetic scheme is given of the steps which must be taken in order to obtain realistic columnar size distributions from spectral aerosol attenuation data. Examples of retrieved aerosol size distribution from actually measured aerosol optical depths are shown.

Results determine which method provides the most objective analysis of the measured data. Author (ESA)

N81-26649# European Centre for Medium-Range Weather Forecasts, Reading (England).
THE IMPACT OF SATELLITE WINDS AND TEMPERATURES ON THE NUMERICAL WEATHER PREDICTION
L. Bengtsson *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 33-40 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

The importance of satellite measurement of winds and temperatures for the planning and establishment of a global observing system is reviewed. Preliminary results from the first GARP global experiment (FGGE) show that satellite observations are necessary for global weather prediction. The effect is usually very small for the Northern Hemisphere, but substantial for the Southern Hemisphere. Prediction experiments show that the mix of observations during FGGE is very suitable for numerical weather prediction. Author (ESA)

N81-26650# National Oceanic and Atmospheric Administration, Madison, Wis. National Earth Satellite Service.
INTERACTIVE PROCESSING AND METHODS
W. L. Smith *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 43-44 (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

The use of man/machine interactive data processing systems for interpreting satellite data and amalgamating these data with conventional observations to form meteorological analyses is discussed. Meteorological results obtained over the United States and the Mediterranean, using interactive processing methods, are cited. The first results achieved with the VISSR atmospheric sounder geostationary satellite launched in September 1980 are discussed, and future prospects are identified. Author (ESA)

N81-26651# Deutscher Wetterdienst, Offenbach am Main (West Germany).
SATELLITE IMAGE PROCESSING AND DISPLAY SYSTEM IN OFFENBACH, WEST GERMANY
H. Woick *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 45-47 (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

A satellite image processing and display system which can be used in weather analysis and forecasting for routine applications is presented which makes more efficient use of satellite data than in the past. This implies the introduction of modern techniques of digital image processing and displaying. The system as implemented at present consists of three major components: the primary data users station with VIZIR hardcopy device; a PDP 11/70 minicomputer; and a COMTAL VISION ONE/20 display system. Direct acquisition of digital imagery by the system described is only possible for Meteosat images. Expansion of the system to include NOAA 6 data is planned. Author (ESA)

N81-26652# Etablissement d'Etudes et de Recherches Meteorologiques, Paris (France).
INTERACTIVE DISPLAY SYSTEM FOR THE OPERATIONAL USE OF METEOSAT
F. R. Cayla and C. Pastre *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 49-51 (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

An image distribution network to be implemented for the establishment of an operational Meteosat system is described. This system brings to the forecasters of regional centers and important stations all available satellite data corresponding to their forecast zones, and offers the possibility of displaying those data simultaneously with those of other sources, such as radar or numerical forecast. Images are transmitted on telephone lines at 2400 bit/sec to the different stations through a central dispatching node. Data compression techniques are used to reduce by a factor of 2 the number of bits necessary for transmission. The images differ in source and their characteristics vary as to geometry, radiometric content, and number of coding levels. Data comprehends Meteosat IR, Meteosat visible, NOAA AVHRR IR, NOAA AVHRR visible, radar images with 5 km resolution on 4 bits per point, and analyzed or forecast charts, either as graphics (5 km and 1 bit per point) or fields (4 bits per point). Author (ESA)

N81-26653# European Space Operations Center, Darmstadt (West Germany).
SATELLITE WINDS, THEIR ACCURACY AND IMPACT
M. Fea *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 55-60 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Methods for operational extraction of cloud motion vectors from the displacement of cloud patterns as seen by a geostationary satellite are reviewed. Different strategies are considered as well as the problems arising with remote sensing techniques. The accuracy of cloud motion vectors producted by the geostationary satellites in operation during the first global weather experiment is analyzed in comparison with the quality of Meteosat 1 products, and the impact of satellite winds on weather analysis and forecasting is also discussed. Author (ESA)

N81-26654# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
A RAPID SURVEY OF VARIOUS METHODS OF SATELLITE WIND DETERMINATION
P. Sitbon *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 61-63 (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Wind determination by cloud displacement analysis is discussed and compared with alternative methods. Cloud winds determination, using cross correlation methods, and numerical methods which optimize the quality of the results along with the computing time are emphasized. Other methods briefly considered include various satellite-borne Doppler shift measurements and the JANUS method, i.e., cross correlation of two pictures obtained from the same scanning radiometer. In conclusion, cloud winds extraction from geostationary satellite pictures can be considered as operational even if some difficulties remain. Other methods are as yet in the research stage. Author (ESA)

N81-26655# Aeronautica Militare Italiana, Rome.
THE ACCURACY OF METEOSAT WINDS OVER THE MEDITERRANEAN
B. Bizzarri and R. Sorani *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 65-70 (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

The results of a comparison between Meteosat derived winds and gradient winds computed from geopotential height analysis are given. As reference the same comparison is run between radiosonde winds and analysis computed winds. The data set is relative to the Mediterranean area. The correlation coefficients show that, although the accuracy of Meteosat winds (and radiosonde winds as well) decreases with increasing height, the information they account for is approximately constant at all levels. Radiosonde winds show somewhat higher correlation, but this is to be expected as they were used in drawing the reference analysis. Author (ESA)

N81-26656# European Space Operations Center, Darmstadt (West Germany).
OBJECTIVE ANALYSIS OF CLOUD FIELDS
C. T. Tomassini *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 73-78 (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

The problem of cluster analysis and the most common techniques used for satellite image data multispectral analysis are detailed. The method used in processing Meteosat data is described. Objective analysis means a process whose aim is to extract all information contained in a set of measurements. Usually this set of data consists of an array of image elements (pixels) recorded by a satellite instrument in different regions of the electromagnetic spectrum and representing the radiance emitted by the bodies seen by the satellite instrument in these bands.

The technique used to recognize the objects in a given region (segment) of the image recorded by the satellite is the analysis of the radiance distribution in that region. Using the infrared and the visible channel measurements it is possible to create histograms of the reflectivity and of the temperature for the objects present in the segment. Analysis of these histograms is elucidated. Author (ESA)

N81-26657# Ministero dell'Agricoltura e delle Foreste, Rome (Italy). Central Office of Agricultural Ecology.
USE OF METEOROLOGICAL SATELLITES FOR THUNDERSTORM OBSERVATIONS: FIRST RESULTS OBTAINED FROM METEOSAT-1
R. Caponigro *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 81-84 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Various Meteosat images were studied in order to investigate the possibility of using the Meteosat system for the observation of thunderstorms, particularly hailstorms, at middle latitudes. A simple and repeatable treatment of the images that can be used for operational purposes of meteorological services on a local scale is specified. The processing method is based on the digital analysis of images, identifying from among cloud bodies those of a cellular form and those with lowest radiance in the thermic IR band. The hypothesis is that these correspond to convective clouds with strong vertical growth. Twelve storms that occurred in the northeastern Po Valley were reconstructed, using thunderstorm ground truth data and Meteosat imagery. A synthesis of the ground data and the Meteosat image analysis serves as an example of the method proposed and of the good results that can be obtained. Author (ESA)

N81-26658# Aeronautica Militare Italiana, Rome.
EXPERIMENTAL USES OF AVHRR IMAGES
B. Bizzarri, G. Renzi, and R. Cossu (Bari Univ., Italy) *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 85-89 Original contains color illustrations (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Examples of experimental uses of advanced very high resolution radiometer (AVHRR) images are shown. The value of these images for coastal zone activities, land use planning and hydrology is demonstrated. Different clusters (sea, land, clouds) are recognized by means of two dimensional histogram analysis followed by color coding of the infrared radiances. Examples are based on TIROS N imagery. Author (ESA)

N81-26659# Danish Meteorological Inst., Copenhagen.
TELECOMMUNICATION MISSIONS
I. K. Ebbesen *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 93-97 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Meteorological satellites are used in solving certain communications problems. For example, collection of data from automatic observation stations is performed both by geostationary satellites and by polar orbiting satellites. Information regarding these missions is given. Different types of data collection platforms are mentioned. The capability of localizing platoforms is discussed. Another use of satellites, namely as substitutes for normal land-line and radio communication (as planned in the SIRIO-2/MDD project) is also considered. Author (ESA)

N81-26660# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
AN APPLICATION OF THE ARGOS LOCATION AND DATA COLLECTION SYSTEM: THE BALSAMINE EXPERIMENT
Paul Sitbon *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 99-101 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

An experiment, using low level superpressure balloons associated with the ARGOS location and data collection system, was conducted successfully during the summer phase of the monsoon 1979 (May to July). How the ARGOS location and data collection system was used for the study of monsoon circulation over the Arabian sea is explained. Eighty-eight balloons, equipped with temperature, pressure, humidity and overpressure sensors were released from Seychelles Islands (60) and Diego-Suarez (28). These balloons were located and the in situ measurements made by the various sensors were collected by the ARGOS system aboard TIROS N and NOAA 6 satellites with real time transmission to a ground station (delay of 1.5 hr). The main stream trajectories of the balloons, before and after the onset of the monsoon, are shown and discussed.
Author (ESA)

N81-26661# European Space Agency, Toulouse (France).
SATELLITE SYSTEM FOR THE DEVELOPMENT OF THE GTS IN AFRICA AND NEIGHBORING REGIONS
A. Jongejans *In its* Satellite Meteorol. in the Mediterranean Feb. 1981 p 103-106 (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

A satellite system dedicated to meteorological telecommunications in Africa is described. The background for the project is given together with the advantages of such a system. Description includes both spacecraft payload and small transportable users stations. Author (ESA)

N81-26662# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.
DATA FOR RADIATION CLIMATOLOGY
H.-J. Bolle *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 109-119 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

The World Climate Research Program to determine to what degree climate can be described and eventually predicted by physical/mathematical models is considered. Radiation phenomena are involved in most of the presently identified critical climate processes. A survey on existing radiation data sets from ground networks shows that the observational gaps are considerable and that intercomparison and validation of the data on a global scale is difficult. The World Climate Research Program must therefore rely more and more on meteorological satellite observation systems in order to assess data needs for the investigation of climate processes and for climate modeling.
Author (ESA)

N81-26663# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
SAMPLING PROBLEM IN RADIATION BUDGET MEASUREMENT
A. Berroir *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 121-122 (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

The use of geostationary satellite information to build models of diurnal variations in cloudiness is proposed as a complement to the Earth Radiation Budget Experiment. The diurnal variation of cloudiness is an important factor of uncertainty in the determination of the radiation budget of the Earth from satellite measurements. This influence can be minimized by an appropriate choice of orbits and good interpolation schemes.
Author (ESA)

N81-26664# Etablissement d'Etudes et de Recherches Meteorologiques, Paris (France).
SATELLITE DATA IN ALPEX
F. R. Cayla *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 125-130 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

The Alpine experiment (Alpex), part of GARP, is discussed. The potential for development and testing of products from satellite data is emphasized. Specifics on the study of lee cyclogenesis in the Mediterranean are mentioned, and the use of radar in the Alpex project is considered. The necessity to use satellite data for the detection and analysis of mesoscale weather phenomena is stressed. Also highlighted are the volume of satellite data that will be generated during Alpex, the commitment of various agencies to extract the smaller scale products, and the time and procedures needed to make satellite images available.
Author (ESA)

N81-26665# Belgrade Univ. (Yugoslavia).
MESOMETEOROLOGICAL PHENOMENA AND SATELLITE OBSERVATIONS
D. Radinovic *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 131-137 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Mesoscale atmospheric circulation systems, as a predominant factor in determining local weather and climatic features of mountainous regions are considered. These mesometeorological phenomena can be defined, detected, and tracked using satellite observations. It is proposed that the GARP Alpine experiment be used for satellite mesoscale observation. In order to improve satellite data application, a classification of the mesometeorological phenomena is outlined. Some of the more significant mesometeorological phenomena are illustrated. Author (ESA)

N81-26666# Technische Universitaet, Munich (West Germany). Inst. of Meteorology.
USE OF SATELLITE DATA IN RESEARCH: SOME ASPECTS
H. Fischer *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 141-149 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

The determination of atmospheric parameters, using only passive satellite observations in the visible, infrared and microwave bandwidths is discussed. Recent results for atmospheric temperature, trace gases, turbidity, wind, liquid water content and rainfall rates are presented. The accuracy of the derived parameter distributions is indicated, and the main limitations of the applied techniques are noted. Plans for improved instruments are mentioned, and in some cases the effect on the accuracy of the measured parameter distribution is estimated. Author (ESA)

N81-26667# Centre National de la Recherche Scientifique, Paris (France). Lab. de Meteorologie Dynamique.
TWO EXAMPLES OF QUANTITATIVE DYNAMICAL STUDIES CONDUCTED WITH GEOSYNCHRONOUS SATELLITE DATA
Andre Berroir *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 151-153 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

It is shown that geosynchronous satellites are valuable tools for quantitative studies into the dynamics of the troposphere. Data from geosynchronous satellites are used to elucidate the temporal evolution of mesoscale cloud activity, and to explain the relationship between water vapor channel radiance fields and the dynamics of polar jet streams. Conclusions agree with theoretical investigations. Author (ESA)

N81-26668# Aeronautica Militare Italiana, Rome.
DESIGN OF AN ARCHIVE OF PREPROCESSED SATELLITE DATA
B. Bizzarri and P. Pagano *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 157-165 (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

The main features of the design of a permanent archive of AVHRR images relative to a limited area are described. Before archiving, images are preprocessed, compensating for panoramic distortion, the Earth's rotation, and for north orientation. Radiances are reduced to eight bits, selected between the most frequent values. Author (ESA)

N81-26669# Deutscher Wetterdienst, Offenbach am Main (West Germany).
MESOSCALE PROCESSES AND OROGRAPHICALLY INDUCED CYCLOGENESIS
G. Steinhorst *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 171-179 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Satellite images are used to discuss mesoscale processes such as thunderstorm development, turbulence caused by mountain lee waves, and fog formation and dissipation. These processes, which belong to the most serious weather conditions for aviation, are best interpreted by applying special forecasting techniques using a combination of conventional data, numerical forecast, and mesoscale climatological statistics from satellite imagery. As an example of the results that can be obtained, the mechanism of orographically induced cyclogenesis is described with the aid of satellite imagery. Author (ESA)

N81-26670# Meteorological Office, Bracknell (England).
METEOSAT WATER VAPOR IMAGERY
J. R. Eyre *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 181-186 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Meteosat 6.3 micron channel possesses similar characteristics to 6.3 micron channels on earlier satellites, sensing radiation emitted mainly by water vapor in the middle and upper troposphere. In addition, it provides images of high horizontal resolution equal to that of the IR channel. The images add to the data from other Meteosat channels and allow forecasters to fix the positions of fronts and other weather systems more accurately. Of particular interest in water vapor images are the narrow, dark bands in high and midaltitudes often associated with jet streams. They confirm the existence of very dry bands of air, often of stratospheric origin, which have descended on the poleward side of the jet stream. Author (ESA)

N81-26671# Centre d'Etudes de Meteorologie Spatiale, Lannion (France).
CYCLOGENESIS IN WESTERN EUROPE AND THE MEDITERRANEAN [CYCLOGENESE SUR L'EUROPE DE L'OUEST ET LA MEDITERRANEE]
Y. LeNinivin *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 187-194 refs In FRENCH (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Cyclogenesis is studied, using satellite imagery. Two examples are offered: (1) evolution in cold air around an eddy center, and (2) development on collision of a cold front with advected warm air of tropical origin. The second type of cyclogenesis is illustrated, citing two events. The first treats a cyclone, developing over the Atlantic and moving towards northern Europe. The second describes a cyclone in the Mediterranean around the Gulf of Gabes. The atmospheric turbulence which results is shown to be very similar to that of a tropical cyclone. Author (ESA)

N81-26672# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
SYNOPTIC SCALE WEATHER PHENOMENA IN THE MEDITERRANEAN, ESPECIALLY DURING WINTER AND SPRING IN SATELLITE IMAGERY
M. Eckardt *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 195-203 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Various synoptic scale phenomena for the Mediterranean region are surveyed. Shape, extent and lifetimes of such systems are clearly demonstrated by images from polar orbiting and geostationary satellites. Cloud systems in this scale can be coupled to cyclones, anticyclones and jet streams, but sometimes identification is complicated in this region. There are also great seasonal changes in the apearance of the main systems.
Author (ESA)

N81-26673# Swiss Inst. of Meteorology, Zurich.
THE DARK ZONES OR STRIPS IN METEOSAT IMAGERY
C.-H. Fourcy *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 205-216 refs (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

The black zones and strips appearing on the water vapor channel of Meteosat are explained. The drying found in the vicinity of jet streams and high cells producing these black zones or strips are generated by stratospheric air descending in the tropopause. These black regions also correlate well with an increase in the partial pressure of ozone. Author (ESA)

N81-26674# Aeronautica Militare Italiana, Rome.
THE WEATHER OVER THE MEDITERRANEAN DURING THE

FIRST GARP GLOBAL EXPERIMENT
R. Sorani and S. Zanni *In* ESA Satellite Meteorol. in the Mediterranean Feb. 1981 p 218-303 (For primary document see N81-26645 17-47)
Avail: NTIS HC A14/MF A01

Seven different sets of weather conditions over the Mediterranean are presented and main synoptic features of each situation are shown by weather charts. Characteristic cloud patterns are examined. Data are derived from Meteosat visible, IR, and water vapor channel imagery. The study provides a general survey of typical Mediterranean weather conditions during the first GARP global experiment (1979) and offers some training in image interpretation. Author (ESA)

N81-26675# Air Weather Service, Scott AFB, Ill.
THE WC-130 METEOROLOGICAL SYSTEM AND ITS UTILIZATION IN OPERATIONAL WEATHER RECONNAISSANCE
Rodney S. Henderson Aug. 1980 79 p refs Revised
(AD-A097018; AD-E850004; AWS-TR-80-002) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report discusses the U.S. Air Force WC-130 weather reconnaissance system. It starts with a brief history of weather reconnaissance, then describes the Air Force WC-130 weather reconnaissance system including descriptions of the instrumentation used. The discussion of data dissemination and quality control is followed by discussion of the applications of weather reconnaissance in watching tropical cyclones and in weather modification. GRA

N81-26676# Naval Research Lab., Washington, D. C.
SHOCK AND VIBRATION PERFORMANCE OF WIND INDICATING EQUIPMENT, TYPE F Final Report
E. W. Clements 22 Apr. 1981 27 p refs
(AD-A098894; NRL-MR-4501) Avail: NTIS HC A03/MF A01 CSCL 04/2

The Type F Wind-Indicating system, consisting of a wind-detector, servo-amplifier and indicator, has been subjected to shock and vibration tests in accordance with MIL-S901C and MIL-STD-167-1 Type I respectively. Various functional and structural deficiencies have been found in all three components of the system. These involve the structural design of the components, the materials from which they are made, and the fasteners which hold them together. While it is widely distributed throughout the fleet, the Type F System represents technology of World War II vintage. It is suggested that this system should be replaced by one embodying current instrumentation and measurement techniques and components which have inherently superior reliability in shock and vibration environments. Author (GRA)

N81-26677# Weather Wing (2nd), APO New York. 09012 The 31st Weather Squadron.
TERMINAL FORECAST REFERENCE NOTEBOOK (TFRN) ZARAGOZA AB, SPAIN AND BARDENAS REALES GUNNERY RANGE, SPAIN Final Report
2 Mar. 1981 155 p
(AD-A099101; AD-E850053; Rept-2W/TRN-81/002) Avail: NTIS HC A08/MF A01 CSCL 04/2

This publication provides guidelines for forecasting weather at Zaragoza AB, Spain and Bardenas Reales Gunnery Range, Spain. Included are the local topography, meteorological instrumentation, climatology, customer identified operation limitations and seasonal weather problems. GRA

N81-26678# Electronic Systems Div., Hanscom AFB, Mass. Environmental Surveillance Systems Directorate.
WINDSOUNDING FEASIBILITY DEMONSTRATION
James F. Morrissey 31 Dec. 1980 34 p
(AF Proj. 6420)
(AD-A098949; ESD-TR-81-121) Avail: NTIS HC A03/MF A01 CSCL 04/2

The results of a feasibility demonstration of a system for measuring horizontal winds between the flight level of an aircraft and the Earth's surface are described. The system utilizes a dropsonde to provide measurements of pressure, temperature, and humidity, and, in conjunction with the Omega Navigation System, provides real-time measurements of the vertical wind profile. Author (GRA)

N81-26679# Tel-Aviv Univ. (Israel). School of Engineering.
STRATOSPHERIC RESIDENCE TIMES FROM BALLOON MEASUREMENTS OF WIND SHEARS Final Report, 1 Jul. 1979 - 31 Dec. 1980
Norman Rosenberg Hanscom AFB, Mass. Air Force Geophysics Lab. 31 Jan. 1981 18 p
(Contract F49620-79-C-0180; AF Proj. 2301)
(AD-A098921; AFGL-TR-81-0126) Avail: NTIS HC A02/MF A01 CSCL 04/2

The analysis of winds measured by a corona anemometer during a 10-hour balloon flight in the stratosphere between altitudes of 17 km and 25 km has been completed. Calibration of the anemometer was accomplished by cross-correlation with a wind velocity measured from radar track of the balloon. Instrumental noise in the corona anemometer has been estimated, and its effect on calculation of wind shears is discussed. Stratospheric turbulence has been calculated from local wind shears and local temperature profiles. Author (GRA)

N81-26680# Geological Survey, Lawrence, Kans. Water Resources Div.
PRELIMINARY ANALYSIS OF REGIONAL-PRECIPITATION PERIODICITY Final Water-Resources Investigations
Charles A. Perry Sep. 1980 29 p refs
(PB81-161630; USGS/WRD/WRI-81/017; USGS-WRI-80-74) Avail: NTIS HC A03/MF A01 CSCL 04B

Precipitation variability plays a major role in nearly every aspect of the hydrologic cycle. Precipitation is not a random event, but it occurs after a sequence of prerequisites has been fulfilled. Recent investigations have shown that activity of the Sun can affect atmospheric vorticity, an important factor in precipitation formation. Solar activity is known to be periodic; therefore, through a complex series of physical processes, precipitation variance is solar forced to a certain degree. An example of the effect of cyclic precipitation is presented for the Powder River basin in Wyoming and Montana. GRA

N81-26681# National Oceanic and Atmospheric Administration, Washington, D. C. National Climate Program Office.
NATIONAL CLIMATE PROGRAM FIVE YEAR PLAN
Sep. 1980 115 p refs
(PB81-153603; NOAA-80123101) Avail: NTIS HC A06/MF A01 CSCL 04B

Existing Federal activities related to climate were reviewed. Special projects and activities that are proposed in three categories that will be given special emphasis over the next 5 years are presented. Three special aspects of the program were examined and include: international activities; an intergovernmental climate program that will provide cooperative Federal/State efforts; and experimental climate forecast centers to develop and test innovative approaches to long-range prediction. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-26682 California Inst. of Tech., Pasadena.
TSUNAMIS: HARBOR OSCILLATIONS INDUCED BY NONLINEAR TRANSIENT LONG WAVES Ph.D. Thesis
Thierry Georges Lepelletter 1981 494 p
Avail: Univ. Microfilms Order No. 8105159

The process of excitation of harbors and bays by transient nonlinear long waves and nonlinear shallow water waves generated in a closed rectangular basin by the motion of the basin was examined. Two numerical methods based on finite element techniques were used to solve the weakly nonlinear dispersive dissipative equations of motion and are applied to the basin excitation problem and the transient harbor oscillation problem. The open sea conditions are simulated by including a radiative boundary condition in time at a finite distance from the harbor entrance. For a transient excitation, the validity of the linear theory depends on the value of the Stokes parameter.

The characteristics of source of dissipation which reduce resonance in the harbor are investigated experimentally. The source considered include: laminar boundary friction, leakage losses underneath the harbor walls, and energy dissipation due to flow separation at the entrance of the harbor. The good agreement obtained between the experiments and the nonlinear numerical model developed suggests that this model could be used with some confidence to predict the response characteristics of prototype harbors. Dissert. Abstr.

N81-26683 Brown Univ., Providence, R. I.
ISOTOPIC FRACTIONATION PATTERNS IN PLANKTONIC FORAMINIFERA FROM HOLOCENE SEDIMENTS IN THE INDIAN OCEAN Ph.D. Thesis
William Baetzel Curry 1980 210 p
Avail: Univ. Microfilms Order No. 8111092

Isotopic analyses were performed on eight species of planktonic foraminifera from 45 Holocene core-top samples in the Indian Ocean. Variations in isotopic composition within species of planktonic foraminifera separated into size fractions exhibit three trends: (1) species with positive covariance of carbon and oxygen isotopic composition with changing size fraction (G. sacculifera, G. ruber, G. bulloides); (2) species with negative covariance of carbon and oxygen isotopic composition (O. universa); and (3) species with small carbon isotopic variations associated with large oxygen isotopic variations (G. menardii, G. tumida, G. truncatulinoides (d and s)). Positive covariance of carbon and oxygen isotopic composition within species is likely the result of greater incorporation of metabolic CO2 into the calicification process during juvenile growth stages. This results in lighter carbon isotopic composition in smaller individuals of a species. Dissert. Abstr.

N81-26684# Oregon State Univ., Corvallis. School of Oceanography.
FRONTS 80: PRELIMINARY RESULTS FROM AN INVESTIGATION OF THE WINTERTIME NORTH PACIFIC SUBTROPICAL FRONT
C. A. Paulson and P. P. Niiler Jan. 1981 17 p refs
(AD-A098892; REF-81-2) Avail: NTIS HC A02/MF A01 CSCL 08/10

Contents: Aircraft Expendable Bathythermograph (AXBT) Survey; Satellite Observations of Surface Temperature; GOES Satellite Data; Three Dimensional Thermohaline Structure; Multiship Expendable Bathythermograph (XBT) Survey; Satellite-Tracked Drifters; Surface Atmospheric and Oceanic Variables; Shipboard Meteorological Observations; Doppler-Acoustic Velocity Profiles; Expendable Temperature-Velocity Pressure (XTVP) Measurements; CTD/Velocity Finestructure Measurements; Towed Temperature Cross-Sections; Velocity and Temperature Microstructure; Temperature Microstructure; and Mesopelagic Fishes. GRA

N81-26685# Naval Postgraduate School, Monterey, Calif.
TEST OF THE APPLICATION OF THE TYWAVES MODEL TO PREDICTION OF SWELL IN THE EAST CHINA SEA FROM THREE TROPICAL CYCLONES IN THE WESTERN NORTH PACIFIC M.S. Thesis
Hyong Sun Lee Dec. 1980 117 p refs
(AD-A098813) Avail: NTIS HC A06/MF A01 CSCL 08/3

A method for predicting swell from tropical cyclones using a spectral wave model (TYWAVES) was tested. The model was applied to predicting swell propagating from three typhoons in the Western North Pacific through gaps in the Ryukyu Islands into a region of the East China Sea. The model involves a source region concept which considers only the swell emanating from regions of peak energy in moving typhoons. For three representative typhoons predicted heights were not significantly different from the observed heights. The time of occurrence of the predicted peak height agreed well with observational values for the swell from two typhoons, but lagged by 6-12 hours for the third. The dominant swell period and direction predicted by the model were not verifiable by data available for this study. Shoaling and refraction effects were considered in the prediction, in a simplified way, but attenuation was ignored even for the passage of energy through the Ryukyu Islands. Author (GRA)

N81-26686# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Ocean Science and Technology Lab.
AN ANALYSIS OF MODELLED SHEAR DISTRIBUTIONS DURING THE MILE EXPERIMENT
Alex C. Warn-Varnas and Gretchen Dawson 1 Feb. 1981 41 p refs
(AD-A098901; NORDA-TN-84) Avail: NTIS HC A03/MF A01 CSCL 20/4

The shear in the mixed layer was forecasted and studied for the duration of the MILE experiment. The forecasting was done with the Warn-Varnas and Piacsek (1979) model. The forecasts were initiated from data and driven by the experimentally-measured wind stress, radiation, and latent and sensible heat flux. The duration of forecasts spanned a time frame of several days to a month. The problem of understanding the shear in the mixed-layer region during MILE was approached from two points of view. First, the basic dynamic processes that generate shear were considered. Second, statistical distributions of shear as a function of depth and time were computed. The basic dynamics can be understood by decomposing the velocity into an Ekman-type component and an inertial component. The vertical structure of this velocity can be visualized as a superposition of an inertial oscillation onto an Ekman spiral; the inertial oscillations being excited by abrupt changes in wind stress. In most cases, the maximum shear occurred at the bottom of the mixed layer and near the surface. In some cases, two shear maxima regions were found below the surface. These cases involved situations of rising wind stress from a previous history of low magnitude. GRA

N81-26687# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Ocean Science and Technology Lab.
DATA REPORT FOR OCEANOGRAPHIC/GEOPHYSICAL SURVEYS IN THE NORTHWEST PACIFIC (46-47 N, 159-161 E): USNS SILAS BENT, 2-3 AUGUST 1980 Final Report
J. A. Green and S. D. Trowell Mar. 1981 19 p refs
(AD-A098902; NORDA-TN-81) Avail: NTIS HC A02/MF A01 CSCL 08/10

This note presents the results of a geophysical/oceanographic survey of Area 2 selected from Green and Fleischer (1980). The surveyed area has an average depth of 5300 m and is located on the eastern flank of the Hokkaido Rise. Average unconsolidated sediment thickness is 0.45 seconds of two way travel time (approximately 400 m). These sediments are probably siliceous clays interspersed with volcanic ash layers and their calculated acoustic interval velocity is 1.770-1.860 km/sec. The smoothest bottom and most homogeneous geology appear in the northeastern section of the survey area. This section, an area about 25 km x 25 km, has smooth acoustic basement which is present at the northern base of a seamount located at 46.6 N, 159.8 E. Residual magnetic lineations are also present in this area and may represent Cretaceous quiet zone seafloor spreading anomalies. In the western part of the survey area, the bottom and acoustic basement are rougher than in the eastern part. The local geology is less homogeneous because seamounts are present. Residual magnetic anomalies are generally associated with seamounts and no correlatable lineations are apparent. Author (GRA)

N81-26688# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Ocean Science and Technology Lab.
TEST AND EVALUATION OF AN OPERATIONALLY CAPABLE SYNOPTIC UPPER-OCEAN FORECAST SYSTEM
R. Michael Clancy, Paul J. Martin, Steve A. Piacsek, and Kenneth D. Pollak Apr. 1981 73 p refs Presented at the Ocean Prediction Workshop, Monterey, Calif., 29 Apr. - 2 May 1981
(AD-A098908; NORDA-TN-92) Avail: NTIS HC A04/MF A01 CSCL 04/2

This paper was prepared for the Ocean Prediction Workshop held at the Naval Postgraduate School, 29 April through 2 May 1981. It describes the first generation of operationally capable synoptic upper-ocean forecast models implemented at Fleet Numerical Oceanography Center via the Thermodynamical Ocean Prediction System (TOPS), and discusses potential uses for their output products. Several examples of one dimensional verification of the turbulence parameterization scheme currently used in TOPS are presented and discussed. In addition, formalism for large-scale

synoptic verification of short-term ocean thermal predictions is developed and applied to a test and evaluation of TOPS that was carried out using operational data from the fall of 1980. Results from this 45-day testing period indicate that TOPS can routinely forecast large-scale sea surface temperature changes over periods of several days with a useful level of skill. This marks the practical beginning of operational synoptic ocean prediction. Author (GRA)

N81-26689# British Columbia Univ., Vancouver. Inst. of Oceanography.
SYNOPTIC ESTIMATES OF AIR SEA FLUXES Ph.D. Thesis
Richard Frank Marsden Oct. 1980 221 p refs Sponsored in part by Natural Science and Engineering Research Council of Canada
(Contract N00014-76-C-0446; NR Proj. 083-207)
(AD-A099142) Avail: NTIS HC A10/MF A01 CSCL 08/10

Synoptic and climatological dynamic studies generally rely on bulk aerodynamic flux formulae to describe air sea heat and momentum exchange on synoptic and climatological scales. Barometric pressure maps (which involve an intrinsic temporal averaging of the wind) and wind roses provide two sources of spatial and temporal wind information for flux calculations. Several investigators have shown that, due to the non-linear dependence of the bulk aerodynamic formulae on the winds, time-averaged estimates of the fluxes based on vector averaged winds systematically underestimate the actual time-averaged fluxes. Using 10 to 21 years of three-hourly sampled sea surface meteorological observations from 9 weatherstations in the North Atlantic Ocean and 2 weatherstations in the North Pacific Ocean, the three hourly stresses, latent heat fluxes and sensible heat fluxes were calculated. The sampled data and the calculated fluxes were then averaged over periods varying up to 28 days. The estimates of the averaged fluxes based on the vector averaged winds were then compared to the directly averaged values. GRA

N81-26690# Teledyne Micronetics, San Diego, Calif.
RCS MATRIX STUDIES OF SEA CLUTTER Final Report, Oct. 1979 - Mar. 1981
Lee A. Morgan and Steven Weisbrod Mar. 1981 71 p
(Contract N00019-79-C-0625)
(AD-A099191; R5-81) Avail: NTIS HC A04/MF A01 CSCL 17/9

The report describes the development of a mobile experimental facility for making observations of RCS matrix properties of sea clutter and of targets in sea clutter. The equipment is mounted in a van which was towed to a site on Pt. Loma at the NOSC facility in San Diego. Preliminary measurements on clutter and targets of opportunity were taken and analyzed. The analysis confirms the salient features of sea clutter properties deduced from the NRL Four Frequency Radar data collected some ten years ago. Experimental results also show that RCS matrix data is used in target signatures which should eventually lead to the development of an effective technique for target classification. GRA

N81-26691# Woodward-Clyde Consultants, Houston, Tex.
SHOREFACE: SURF ZONE SEDIMENT EXCHANGE PROCESSES AND SHORE FACE DYNAMICS
Alan W. Niedoroda Oct. 1980 99 p refs
(Grant NOAA-03-6-D22-35113)
(PB81-154171; NOAA-TM-OMPA-1; NOAA-80123107) Avail: NTIS HC A05/MF A01 CSCL 08C

Detailed field experiments were conducted to determine the ocean kinematics and dynamics which dominate bedload sediment transport in a typical shoreface environment. The experiments involved high resolution current meters and wave staffs mounted on tripods in the surf zone, ocean boat stations distributed across 3.5 km wide shore normal transect, sediment samples obtained from grab samplers, and other data. Emphasis was placed on obtaining sufficiently detailed information on the geometry of the shoreface, sediments of the shore face, and fluid shear stresses acting on the shoreface to permit calculations of the sediment transport. T.M.

N81-26692# Southern California Coastal Water Research Project, Long Beach.
COASTAL WATER RESEARCH PROJECT BIENNIAL REPORT Progress Report, 1 Jan. 1979 - 31 Dec. 1980
Willard Bascom 1980 359 p refs
(PB81-158271; SCCWRP-AR6-79) Avail: NTIS HC A16/MF A01 CSCL 08A

Coastal conditions along the Palos Verdes peninsula are discussed. The number of species of intertidal algae is greater now than in 1910, the large kelp beds now cover 240 hectares, and most microcrustaceans (a favorite fish food) are back thus attracting two species of fish not seen in the area for nearly 10 years. New toxicity tests are described. Sludge disposal in Santa Monica Bay is described. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

No abstracts in this category.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-26693* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 220, JUNE 1981
Jun. 1981 53 p
(NASA-SP-7011(220)) Avail: NTIS HC $7.00 CSCL 06E

Approximately 137 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1981 are recorded, covering a variety of topics in aerospace medicine and biology. S.F.

N81-26694 California Univ., Los Angeles.
EVALUATION OF HUMAN POWER CAPACITY THROUGH OLYMPIC WEIGHTLIFTING ANALYSES Ph.D. Thesis
John Joseph Garhammer, Jr. 1980 101 p
Avail: Univ. Microfilms Order No. 8111224

Magnitudes of human output for various phases of the competitive lifting movements were studied. The power capacity exhibited consistencies associated with the corresponding movement speeds related to the classical force velocity (F-V) relationship for skeletal muscle. Energy flow analysis of olympic lifting movements indicates the primary importance of leg and hip musculature as is the case for jumping. The concept of stored elastic energy was utilized to explain the high power output for the relatively slow jerk thrust movement. It was found that in addition to training, one reason for the near maximal power outputs of olympic lifters is the utilization of previously stored elastic energy. Dissert. Abstr.

N81-26695 Kansas Univ., Lawrence.
THE CONTROL OF BRAIN BLOOD FLOW DURING VARIOUS BLOOD OXYGEN LEVELS Ph.D. Thesis
Lorin Craig Wagerle 1980 120 p
Avail: Univ. Microfilms Order No. 8111759

The vascular response of the brain to alterations in arterial blood oxygen tension (PaO2) was investigated in unanesthetized ponies. The use of internal carotid artery flow was validated as a representative sample of brain blood flow during rest and during hypoxia. The transient and steady state cerebrovascular responses to three levels of isocapnic hypoxia and to one level of hyperoxia were determined. Internal carotid artery blood flow increased and internal carotid artery peripheral resistance decreased rapidly during the 2 to 3 minutes of hyperoxia, and coincided with a transient increase in arterial PCO2. After this initial increase, arterial PCO2 was restored to isocapnic levels and internal carotid blood flow decreased slightly, internal carotid peripheral resistance increased from control. These data indicate

that steady state isocapnic hyperoxia causes slight cerebral vasoconstriction. Dissert. Abstr.

N81-26696 Brown Univ., Providence, R. I.
LIGHT ADAPTATION AND LATERAL INHIBITION IN THE VERTEBRATE RETINA Ph.D. Thesis
Jaime Alberto Castano 1980 178 p refs
Avail: Univ. Microfilms Order No. 8111077

Light adaptation and lateral inhibition in the vertebrate retina are characterized in a concise way so as to make these properties amenable to modeling, and then light adaptation and lateral inhibition are modeled simultaneously in the distal retina using known electrical properties of receptors and horizontal cells. The main purpose of the model is to examine possible mechanisms of light adaptation and lateral inhibition that would result from electrical properties of reception and horizontal cells. Computer simulation of the electrical response of the model shows properties that are also found in cell recordings: saturation; spatial summation; and antagonistic center-surround receptive field organization. In the model lateral inhibition is a consequence of the resistance of the extracellular space in the receptor terminal invagination and the lateral inhibition effect is present in the potential of the invagination and of the horizontal terminals. Light adaptation on the other hand is a consequence of a slowly changing voltage-dependent membrane resistance in the receptor. Dissert. Abstr.

N81-26697*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM FOR MOVING A PROBE TO FOLLOW MOVEMENTS OF TISSUE Patent Application
Cyril Feldstein (JPL, California Inst. of Tech., Pasadena), Thomas W. Andrews (JPL, California Inst. of Tech., Pasadena), Donald W. Crawford (JPL, California Inst. of Tech., Pasadena), and Mark A. Cole, inventors (to NASA) (JPL, California Inst. of Tech., Pasadena) Filed 15 May 1981 15 p
(Contract NAS7-100)
(NASA-Case-NPO-15197-1; US-Patent-Appl-SN-263957) Avail: NTIS HC A02/MF A01 CSCL 06B

An apparatus is described for moving a probe that engages moving living tissue such as a heart or an artery that is penetrated by the probe, which moves the probe in synchronism with the tissue to maintain the probe at a constant location with respect to the tissue. The apparatus includes a servo positioner which moves a servo member to maintain a constant distance from a sensed object while applying very little force to the sensed object, and a follower having a stirrup at one end resting on a surface of the living tissue and another end carrying a sensed object adjacent to the servo member. NASA

N81-26698# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
INFERRING SHAPE FROM MOTION FIELDS
D. D. Hoffman Dec. 1980 21 p refs
(Contract N00014-80-C-0505; Grant NSF MCS-79-23110)
(AD-A099150; AI-M-592) Avail: NTIS HC A02/MF A01 CSCL 12/1

The human visual system has the ability to utilize motion information to infer the shapes of surfaces. More specifically, we are able to derive descriptions of rigidly rotating smooth surfaces entirely from the orthographic projection of the motions of their surface markings. A computational analysis of this ability is proposed based on a 'shape from motion' proposition. This proposition states that given the first spatial derivatives of the orthographically projected velocity and acceleration fields of a rigidly rotating regular surface, then the angular velocity and the surface normal at each visible point on that surface are uniquely determined up to a reflection. The computational analysis proceeds in three main steps. First it is shown that surface tilt and one component of the angular velocity may be obtained entirely from the first spatial derivatives of the velocity field. Second it is shown that surface slant and the remaining two components of the angular velocity are computable if the first spatial derivatives of the acceleration field are also given. Finally the problem of constructing a velocity field from the temporally changing optic array is briefly discussed. Author (GRA)

N81-26699# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE EFFECT OF LONG TERM THERAPEUTICS, PROPHYLAXIS AND SCREENING TECHNIQUES ON AIRCREW MEDICAL STANDARDS
C. E. Simpson, ed. (Ministry of Defense, London) Mar. 1981 147 p refs In ENGLISH and FRENCH Conf. held at Toronto, 15-19 Sep. 1980
(AGARD-CP-310; ISBN-92-835-0288-4) Avail: NTIS HC A07/MF A01

The effects of high stress missions on flight crew members is surveyed. Medical standards, screening, and selection of aircrews are described, as well as epidemiology and medical treatment. For individual titles, see N81-26700 through N81-26717.

N81-26700# Institute of Aviation Medicine, Oslo (Norway).
PHYSICAL FITNESS AND CARDIOVASCULAR CAPACITY: AN EPIDEMIOLOGICAL PROGRAM
Kjell Myhre, Egil Alnaes, and Harald T. Andersen *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 7 p refs (For primary document see N81-26699 17-52)
Avail: NTIS HC A07/MF A01

A longitudinal survey was conducted of the way of living of all personnel with flying status in terms of diet, smoking and drinking habits, and habitual physical activity, in addition to anthropometrical/physiological parameters such as weight, percentage of fat, maximal aerobic power, serum concentrations of triglycerides, total cholesterol and HDL cholesterol. This information is obtained from each subject during his periodical major medical examination at the Institute of Aviation Medicine, which is every sixth year when the subject is below 40 yrs of age, otherwise every third year. This program is discussed. S.F.

N81-26701# Institute of Aviation Medicine, Manching (West Germany).
CHANGES IN PHYSICAL FITNESS DUE TO VARIATIONS IN PHYSICAL ACTIVITY AND DIET
Harald T. Andersen and Kjell Myhre *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 4 p refs (For primary document see N81-26699 17-52)
Avail: NTIS HC A07/MF A01

Physical deterioration in 122 young pilots and navigators of the Royal Norwegian Air Force was studied over the 5-year period 1972-1977. A net gain in body weight with no simultaneous increase in aerobic capacity was interpreted as an early, but serious, sign of physical degeneration. S.F.

N81-26702# School of Aerospace Medicine, Brooks AFB, Tex. Crew Technology Div.
PHYSIOLOGICAL CRITERIA RELATED TO G TOLERANCE IN COMBAT AIRCREW
James E. Whinnery *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 14 p refs (For primary document see N81-26699 17-52)
Avail: NTIS HC A07/MF A01

Initial studies measuring the +Gz tolerance of 59 USAF aircrewmen undergoing aeromedical evaluation were made on the USAF School of Aerospace Medicine (USAFSAM) human centrifuge using a specific centrifuge stress medical evaluation protocol. Clinically measurable parameters were found to be associated with +Gz tolerance. In addition, the use of the centrifuge stress medical evaluation protocol to detect medically significant cardiac dysrhythmias was investigated. The types of dysrhythmias and their time of onset give added insight into the physiologic response of man to +Gz stress. S.F.

N81-26703# Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France).
THE EFFECTS OF ACCELERATION ON COMBAT PILOT PERFORMANCE [ACCELERATIONS ET APTITUDE DES PILOTES D'AVIONS DE COMBAT]
B. Vettes, G. Leguay (Hospital d'Instruction des Armees), H. Viellefond (Hospital d'Instruction des Armees), A. Seigneuric, and R. Auffret *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 9 p In FRENCH (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

The cardiovascular system is the target of the stress factors associated with flight in combat aircraft. Consequently, examination of the heart and vessels receives all the attention of the experts during physical fitness examinations of aircraft pilots on admission, and especially during their review visits. It is often useful to evaluate functional circulatory integrity during a standardized test which is reproductive of the cardiovascular stress undergone by the pilot. During the test, the principal cardiovascular parameters are recorded and the visual field evaluated. Televised observation and recorded conversation sheds light on the general behavior of the subject. Experience with a centrifuge provides indispensible supplementary information to the medical record. A.R.H.

N81-26704# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biochemical Protection Branch.

EXPERIENCE WITH HIGHLY SELECTIVE SCREENING TECHNIQUES FOR ACCELERATION STRESS DUTY

Bernard F. Hearon and James H. Raddin *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 8 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

Impact acceleration tests designed to medically screen flight crews for high stress missions were conducted with human volunteers. Facilities included the Vertical Deceleration Tower, the Horizontal Decelerator and the Impulse Accelerator sleds. Disqualifying defects are summarized. S.F.

N81-26705# Royal Air Force, High Wycombe (England).

MANAGEMENT OF UNFIT AIRCREW

M. G. P. Fisher *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 6 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

The implications of unfitness in aircrew due to illness or injury are examined. A general philosophy of care and management directed towards an early and successful return to flying status is suggested. The role of the Flight Surgeon is highlighted as an intermediary between the clinical specialist and the executive, who is responsible for coordinating the evidence required for a rational assessment of the fitness of the man/women as a whole. Examples are given of an unusual case (chondro sarcoma) and of a common injury (ejection spinal fractures). Conditons which currently pose problems of assessment are discussed; hypertension; peptic ulcer; manic depressive psychosis; and sarcoidosis. S.F.

N81-26706# Letterman Army Inst. of Research, San Francisco, Calif. Div. of Biorheology.

A SOLID-STATE DARK ADAPTOMETER: THE LAIR DARK ADAPTOMETER

Harry Zwick, Peter A. OMara, Edwin S. Beatrice, Silmon L. Biggs, and Charles W. VanSice *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 10 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

The eye's ability to adjust from a very bright light to a very dim lignt environment is known as dark adaptation. A dark adaptometer was developed which is considerably less complicated than other dark adaptometers. Interface with a low cost microcomputer system allows clinical flexibility for routine military screening and research flexibility for investigators studying the role of dark adaptation in military tasks. The data presented validate the use of this device for such applications. S.F.

N81-26707# Institute of Aviation Medicine, Manching (West Germany).

SCREENING FOR NOISE INDUCED HEARING LOSS IN NORWEGIAN AIR FORCE

H. M. Borchgrevink *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew and Standards Mar. 1981 4 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

A hearing loss prophylaxis program for the Norwegian Armed Forces is detailed. The program includes: (1) a central archive of noise level registrations for civil and military work situations; (2) the publishing and distribution of noise level measurements, risk criteria and recommended prophylactic initiatives to the various work places; and (3) audiometry of personnel. S.F.

N81-26708# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Aviation Vision Lab.

PROPOSED NEW VISION STANDARDS FOR THE 1980'S AND BEYOND: CONTRAST SENSITIVITY

Arthur P. Ginsburg *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 15 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

Data are presented that reveal individual differences in contrast sensitivity among normal observers that have definite implications for visual performance in operational environments. Since these differences in visual sensitivity can relate to detection and recognition ranges, these data can then be transformed into time to perform certain tasks and lead naturally towards visual standards being based on task performance under operational conditions. It is suggested that contrast sensitivity data be obtained in parallel with conventional vision tests to begin creating visual standards that relate to observer capability over the full range of operational environments. E.D.K.

N81-26709# School of Aerospace Medicine, Brooks AFB, Tex. Neuropsychiatry Branch.

BIOFEEDBACK REHABILITATION OF AIRSICK AIRCREW

Richard A. Levy, David R. Jones, and Erin H. Carlson *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 4 p (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

The current treatment program for airsickness is reported in detail, describing treatment method and results. This program is based on biofeedback relaxation training and physiological monitoring in a motion stimulus environment. Twenty aircrew disabled by chronic, severe airsickness were treated and followed. Two of this group were subsequently grounded for reasons unrelated to motion sickness, 2 were deleted from UPT due to continued motion sickness, 1 was disqualified from back-of-aircraft radio operator duties due to motion sickness, and 15 were successfully returned to operational flying. E.D.K.

N81-26710# Institute of Aviation Medicine, Fliegehorst (West Germany). Dept. of Aviation Psychology.

PSYCHOLOGICAL THERAPY AND PREVENTION OF STRESS REACTIONS IN GERMAN MILITARY PILOTS

Reiner W. Kemmler *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 11 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

The disturbances of 44 aviators of the German Military are described and documented. The people concerned were pilots and navigators involved in a psychological intervention and counselling program over a period from 1973 to 1979. The aim was flying rehabilitation. The somatic, psychic, and social symptoms are analyzed under the heading of modern stress conceptions. Psychological prevention methods are proposed in order to reach a better stress tolerance. With high probability, these procedures will modify the operational behavior patterns under extreme mission conditions helping to prevent disturbances of health and minimize flight safety risks. E.D.K.

N81-26711# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

DETECTION OF DIAZEPAM AND DETERMINATION OF TIME OF INGESTION IN AIR ACCIDENT/INCIDENT INVESTIGATION

Linda J. McBurney *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 8 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

The temporal excretion patterns of unchanged diazepam metabolites are studied to determine if there was a relationship between metabolite ratios and the time of ingestion. A clinical study was carried out using gas chromatography-mass spectrom-

etry (GC/MS) to verify the presence of and to quantitate diazepam metabolites in the urine of human subjects after a single 10 mg dose. E.D.K.

N81-26712# Institute of Aviation Medicine, Manching (West Germany).

CARDIOVASCULAR RISK FACTORS IN THE PILOT POPULATION: A POLICY DISCUSSION

Egil Alnaes and Harold T. Andersen *In* AGARD The Effect of Long-Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 5 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

Several large scale prospective investigations have recently quantified the cardiovascular risk factor pattern in the Scandinavian male population. Since the small population in Norway is biologically and sociologically homogeneous, it is possible to (1) extrapolate from current epidemiological research in Scandinavia to the aircrew population; (2) perform periodic standardized/centralized medical examination and evaluations; and (3) remain in close personal contact with each aircrew member throughout his total career. A risk profile will be established for each aircrew candidate at the point of training entry and monitored annually throughout his career. Among other medical information this will contain family history, cholesterol/HDL ratio, smoking habits, level of physical fitness, etc. Significant changes in any individual's risk factor profile will be a cause for personal counseling and/or minor modifications/restrictions in medical flight status. E.D.K.

N81-26713# Aerospace Medical Div., Brooks AFB, Tex.

DETECTION OF CORONARY ARTERY DISEASE IN ASYMPTOMATIC AIRCREW MEMBERS WITH THALLIUM-201 SCINTIGRAPHY

Gregory S. Uhl, Michael A. Montgomery, and George M. McGranahan *In* AGARD The Effect of Long Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 5 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

Thallium-201 exercise myocardial perfusion scintigraphy was accomplished in 130 aircrew members prior to their undergoing coronary angiography. Most were undergoing cardiac catheterization for an abnormal exercise response to treadmill testing. Of these, 22 men had arteriographic evidence of obstructive coronary disease of at least 50% narrowing in a single vessel. All had abnormal myocardial scintigrams. There were 12 other aviators who had minimal degrees of coronary artery disease with lesions less than 50% as the maximum degree of obstruction. Of these, 8 had abnormal thallium scans showing a perfusion defect in the area of the myocardium, presumably supplied by the diseased coronary artery. Of the 96 men with normal angiograms, only 4 had abnormal myocardial scintigraphy. An abnormal myocardial scintigram was often associated with significant obstructive disease. A normal scan accurately ruled out the presence of high grade obstructive lesions and missed only 4 cases of minimal coronary disease. E.D.K.

N81-26714# Hellenic Air Force Aeromedical Center, Athens (Greece).

PILOTS WITH CARDIOLOGICAL PROBLEMS: TEN YEAR FOLLOW UP

G. B. Masdrakis, C. E. Giannopoulos, and N. Kalogerakis *In* AGARD The Effect of Long Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 6 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

It is known that a number of flyers with cardiological problems, such as repolarization changes, conduction defects, rhythm abnormalities or hypertension are maintained on flying status if the successive complete medical evaluation is normal. The follow-up of these flyers for an indefinite period of time is important because it gives the possibility to follow the physical history of cardiac abnormalities in a select group of subjects. The medical files of active airline pilots and Hellenic Air Force Flyers are reviewed in order to determine (1) how many are maintained on flying status although presenting cardiac abnormalities and (2) the evolution of these abnormalities. E.D.K.

N81-26715# Royal Air Force Hospital, Halton (England).

USE OF BETABLOCKADE IN THE TREATMENT OF AIRCREW WITH HYPERTENSION

J. N. C. Cooke *In* AGARD The Effect of Long Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 5 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

The use of drugs which blockade beta adrenergic recaptors as a treatment for engine and ischaemic heart disease is reviewed. The reasons for using these drugs in the treatment of hypertension in flight crews are summarized. Side effects of betablocking agents are discussed in relation to pilot performance. E.D.K.

N81-26716# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

INFLUENCE OF BETA BLOCKING ATENOLOL AND OTHER MEDICATION ON THE REACTION TIME OF THE VISUAL SYSTEM

D. Harms, E. Pachale, and D. Nechvatal *In* AGARD The Effect of Long Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 5 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

Visual reaction time as a measure of vigilance and of the psychophysiological condition of subjects was determined after combined physical and mental stress to examine B-blocker influence. Using the technique of electrooculography 40 subjects were measured in a double-blind cross over design after applications of placebo or 50 mg of atenolol (TENORMIN) for 3 days. Visual reaction time was defined as the time between display of a peripheral light signal and the start of the eye movement that shifts the direction of gaze from the reference point to the stimulus. The results of the study show that under these experimental conditions there is a positive effect of beta-blocker medication on vigilance. In order to prove the sensitivity of the test method in a preliminary study, the effects of the well described drugs fenetyllin-hydrochlorid, diazepam, oxazepam, and alcohol on visual reaction time were investigated. E.D.K.

N81-26717# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

CONSIDERATIONS ON LONG TERM THERAPY OF HYPERTONIA, LIPOMETABONIC DISORDERS AND STRUMA IN FLYING PERSONNEL

W. Nissen and L. Gall *In* AGARD The Effect of Long Term Therap., Prophylaxis and Screening Tech. on Aircrew Med. Standards Mar. 1981 9 p refs (For primary document see N81-26699 17-52)

Avail: NTIS HC A07/MF A01

Long term drug therapy in flying personnel is thought to be necessary only in very few instances, as illustrated in cases involving hypertension, hyperlipoproteinemia (HLP) and euthyroid struma in the pilot population. Sound medical advice and guidance in cases of hypertension and HLP are considered more important than drug therapy. Long term treatment of euthyroid struma with thyroid hormones is only practical in rare cases. E.D.K.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-26718* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

PNEUMATIC INFLATABLE END EFFECTOR Patent
Keith H. Clark and James D. Johnston, inventors (to NASA) Issued 16 Jun. 1981 4 p Filed 22 Sep. 1978 Supersedes N78-32724 (16 - 23, p 2133)
(NASA-Case-MFS-23696-1; US-Patent-4,273,505; US-Patent-Appl-SN-945044; US-Patent-Class-414-735; US-Patent-Class-294-93; US-Patent-Class-414-4; US-Patent-Class-414-744A) Avail: US Patent and Trademark Office CSCL 13I

The invention relates to an end effector device for robot or teleoperated type space vehicle which includes an inflatable balloon member carried on the end of tubular member which has a hollow center or conduit through which a suitable pressurized fluid is supplied. The device may be inserted into a variety of shaped openings or truss-type structures for handling in space.
Official Gazette of the U.S. Patent and Trademark Office

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N81-26719 Pennsylvania State Univ., University Park.
ANALYSIS OF THE LOGICAL DESIGN IN RELATIONAL DATABASES Ph.D. Thesis
Don-Min Frank Tsou 1980 101 p
Avail: Univ. Microfilms Order No. 8107644

The mathematical concept underlying the relational model is the set-theoretic relation, which is considered as a two dimensional table such that each column is labeled by an attribute. Several types of constraints among the attributes are defined. Functional and multivalued dependencies are the most significant of these. Some properties of a database scheme and the algorithms for obtaining a database scheme with good properties are studied. The concepts of kernel and support are introduced to characterize the lossless-join property in a database scheme. The complexities of finding a minimal kernel or a minimal support in a database scheme are discussed. Dissert. Abstr.

N81-26720 Washington Univ., Seattle.
ASSIGNMENT OF DEPENDENT TASKS TO DISTRIBUTED PROCESSORS Ph.D. Thesis
Emily Ann C. Plachy 1980 215 p
Avail: Univ. Microfilms Order No. 8111844

The problem of how to assign dependent tasks to a network of distributed processors so that the tasks execute in minimal time is investigated. A model for the general distributed processor assignment problem is developed, and distributed processing systems are divided into four performance classes based on the amount of parallelism available in the network. Because the problem belongs to the class of NP complete problems, it is unlikely that a polynomial-time algorithm exists which finds a minimal assignment for the general distributed processor assignment problem. However, algorithms are presented which efficiently find optimal assignments for two of the performance classes for assignment problems with equal task times, equal communication times, and binary tree structured precedence graphs. Fast heuristic algorithms are presented for all four performance classes with equal task times, equal communication times, and tree structured precedence graphs. The importance of providing for parallel task processing and message processing at each processing node in a distributed processing system is established. Dissert. Abstr.

N81-26721 Pennsylvania State Univ., University Park.
THEORY OF FUNCTIONAL RELATION SCHEMES IN RELATIONAL DATABASES Ph.D. Thesis
Jiann Huei Jou 1980 97 p
Avail: Univ. Microfilms Order No. 8107586

Definitions of third and Boyce-Codd normal form relation schemes are simplified via the notion of abnormal attributes. Properties of these two normal forms are also examined via the notion of normative relation schemes. Results include: (1) the number of functional dependencies for a relation subscheme may be exponential in the number of functional dependencies in its parent relation scheme; (2) testing whether a decomposition is faithful can be done in polynomial time; (3) testing whether a relation scheme is in third normal form is NP-hard; (4) for each epsilon > 0 there is no polynomial time epsilon-approximation algorithm for faithful third normal form decompositions if P does not = NP; (5) normative relation schemes in a faithful decomposition can be replaced by subschemes which are in third normal form without affecting faithfulness in polynomial time.
Dissert. Abstr.

N81-26722 Brown Univ., Providence, R. I.
PERFORMANCE AND TIMELINESS IN A DISTRIBUTED DATABASE Ph.D. Thesis
Lynn Andrews DeNoia 1980 232 p
Avail: Univ. Microfilms Order No. 8111904

A methodology is presented for evaluating the system cost/performance of alternative approaches to distributed database management. For each type of database transaction, the management schemes are analyzed to identify the specific control paths and data flow requirements. Then the control and data flow information is used to develop a queueing network model of the entire system. Specific cost/performance analyses can be made when assumptions about particular operating characteristics (such as communication delays, processor power, and disk rates) are incorporated into the model. Average system response time and average network message traffic are computed for four management approaches: centralized, a master/slave scheme, a synchronized scheme, and a new scheme called delayed synchronization. The new scheme is based on daily operation without synchronizing updates, supported by nightly merging to produce identical data copies throughout the system. Timeliness information is associated with every individual data item and users are given a choice in retrieval transactions between quick response and most recently updated values. Dissert. Abstr.

N81-26723 Duke Univ., Durham, N. C.
PERFORMANCE SYNTHESIS TECHNIQUES TO MINIMIZE THE TURNAROUND TIME OF BATCH-ORIENTED MULTI-PROGRAMMED COMPUTER SYSTEMS Ph.D. Thesis
Joseph Gary Rusnak 1980 234 p
Avail: Univ. Microfilms Order No. 8112316

A performance synthesis technique is derived to solve the following design problem: Find the optimum values of designated system parameters which minimize the turnaround time of a batch-oriented multiprogrammed computer system, subject to a budgetary constraint on the cost of the designed system. In order to derive this technique, an open queueing network model similar to the central server model is analyzed with the help of Norton's theorem for queueing networks. Three applications of this technique are presented. For each of the applications, an example design problem is solved, and the results are discussed.

Several simulation studies are presented which give some examples of the impact of using an approximation to solve the queueing network model. Dissert. Abstr.

N81-26724# Wisconsin Univ. - Madison. Mathematics Research Center.
THE SOLUTION OF LINEAR COMPLEMENTARITY PROBLEMS ON AN ARRAY PROCESSOR
C. W. Cryer, P. M. Flanders (International Computers Ltd., Stevenage, England), D. J. Hunt (International Computers Ltd., Stevenage, England), S. F. Reddaway (International Computers Ltd., Stevenage, England), and J. Stansbury Jan. 1981 57 p
(Contract DAAG29-80-C-0041; Grant NSF MCS-77-26732)
(AD-A099358; MRC-TSR-2170) Avail: NTIS HC A04/MF A01 CSCL 09/2

The Distributed Array Processor (DAP) manufactured by International Computers Limited is an array of 1-bit 200 nanosecond processors. The Pilot DAP on which the present work was done is a 32 x 32 array; the commercially available machine is a 64 x 64 array. We show how the projected SOR algorithm for the linear complementarity problem Aw > or = b, w > or = 0, w(T) (Aw - b) = 0, can be adapted for use on the DAP when A is the 'finite-difference' matrix corresponding to the difference approximation to the Laplace operator. Application is made to two linear complementarity problems arising, respectively, from two and three dimensional porous flow free boundary problems. Author (GRA)

N81-26725# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
A STUDY OF ALTERNATIVE COMPUTER ARCHITECTURES FOR SYSTEM RELIABILITY AND SOFTWARE SIMPLIFICATION Final Report, 1 Aug. 1978 - 31 Dec. 1980
Kenneth J. Breeding 22 Apr. 1981 37 p refs
(Grant AF-AFOSR-3400-77; AF Proj. 2305)
(AD-A098832; AFOSR-81-0441TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

The principle thrust of this work has been the development of special purpose computer architectures aimed at two problem areas. The first area deals with the use of hardware structures to simplify software development and utilization. The second area deals with processing systems for efficiently handling distributed tasks. Author (GRA)

N81-26726# Naval Postgraduate School, Monterey, Calif.
Z8000 SIMULATOR: A TRAINING TOOL
John Moschovinos Apr. 1981 568 p refs
(AD-A099422; NPS52-81-002) Avail: NTIS HC A24/MF A01 CSCL 09/2

This report explores the possibility of the use of a simulator as a training tool for the thorough learning of assembly language and the architecture of the microprocessors and the use of the simulator as a host computer for the building of an operating system in high level language. It also presents the implementation in a high level language of a simulator which simulates the CPU of an advanced microprocessor (Z8000) and his associated software that provides the debugging features and finally it presents the implementation of one pass assembler supporting the assembly language or implemented simulator. Author (GRA)

N81-26727# Mitre Corp., Bedford, Mass.
A SECURE MESSAGE SYSTEM FOR THE SECURE DISTRIBUTED PROCESSING PROJECT Final Technical Report, 1 Oct. 1979 - 30 Sep. 1980
P. Tucker Withington and Daniel J. Solomon Griffiss AFB, N.Y. RADC Mar. 1981 37 p refs
(Contract F19628-80-C-0001)
(AD-A099206; MTR-3955; RADC-TR-81-8) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report documents work performed under a MITRE MOIE project. The report describes the design of a multilevel-secure message system based on the RAND MH message system running under the UNIX operating system. A color terminal is used for control and display of security classifications. Major issues in the user interface, and in interfacing the message system with KSOS are discussed. Author (GRA)

N81-26728# California Inst. of Tech., Pasadena.
SUBMICRON SYSTEMS ARCHITECTURE Progress Report, 1 Jan. - 31 Mar. 1981
Charles L. Seitz and Carver Mead 5 May 1981 7 p
(Contract N00014-79-C-0597; ARPA Order 3771)
(AD-A099374) Avail: NTIS HC A02/MF A01 CSCL 09/2

An assembly language has been defined for the tree machine and its instruction set. The language supports both the notation proposed and used by Sally Browning and the notation proposed and used by Marina Chen in her work on HARMOS. The assembly language contains pseudo instructions for the definition of the interconnections in the logical tree and the logical name of the ports. Macro definition and expansion features are included. These features are used in the generation of padding macros for mapping the logical tree onto the physical tree. The assembler works in three passes. It generates the object code for each processor, does the conversion from the logical tree to the physical tree, and produces information required by the loader. The loader loads a precoded bootstrap loader into each node of the tree before it loads the machine code with proper headers into the tree. Each processor in the tree runs its bootstrap loader and stores its own code into its own memory. The host computer initiates the execution on completion of the loading. GRA

N81-26729# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Computer Sciences and Applied Mathematics.
APPLICATION OF FUZZY SET THEORY TO DATA DISPLAY
W. H. Benson Dec. 1980 9 p refs Presented at Intern. Congr. on Appl. Systems Res., and Cybernetics, Acapulco, Mexico, 12 Dec. 1980
(Contract W-7405-eng-48)
(LBL-11590) Avail: NTIS HC A02/MF A01

Categorization supports decision making and lets an analyst look at data from different perspectives and different levels of detail. An approach to data analysis is described in which membership in subjectively defined categories is modeled by the fuzzy nature of color categories and presented by means of computer graphics for visual inspection by the analyst. DOE

N81-26730# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: INVESTIGATION OF TECHNOLOGY-BASED IMPROVEMENT OF THE ERIC SYSTEM
Siegfried Treu Jun. 1980 121 p refs Sponsored by National Inst. of Education
(PB81-167645; NBSIR-80-2005) Avail: NTIS HC A06/MF A01 CSCL 05B

Potential technology-based improvements in the operation, access, and ultilization of the Educational Resources Information Center are described. Both current problem areas and future possibilities are considered with regard to the dichotomy: system components and the total system. Emphasis is on characterizing the component functions of data input and data output as well as the total system operation in terms of applicable criteria (data type, volume, purpose, performance). Technological alternatives are then discussed with reference to those criteria. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-26731 Kansas Univ., Lawrence.
EQUIVALENT NETWORKS AND BACKWARD TREE SOLUTIONS Ph.D. Thesis
Roger Joseph Schroff 1980 269 p
Avail: Univ. Microfilms Order No. 8111754

Network analysis is treated from a symbolic or functional point of view. The network flow equations for both product form and Markovian networks are shown to involve the solution of similar sets of homogeneous equations. It is shown that these equations may be solved symbolically through an examination of the backward trees of the state transition diagrams. The

applicability of the backward tree theorem to open and closed product form networks involving single or multiple job classes and to networks of the Markovian type is demonstrated. The symbolic solutions provided by the backward tree theorem are examined with regard to the availability of simple expressions that relate station utilization and three parameters; number of jobs, service rate, and routing probability. The backward tree theorem is also used in an investigation of equivalent networks. These equivalences are shown to be effective tools in parametric analysis. Dissert. Abstr.

N81-26732 Washington Univ., Seattle.
A METHODOLOGY FOR THE GENERATION OF GRAPH MODELS OF MULTIPROGRAMS Ph.D. Thesis
Robert Ralph Roediger 1980 146 p
Avail: Univ. Microfilms Order No. 8111845

A methodology is developed to the point where it can be used in the design of multiprograms from sequential programs. The design of multiprograms from sequential programs with decisions and from sequential programs with loops are discussed. The approach presented here is the analysis of graph models of sequential programs for potential concurrency and the synthesis of graph models of multiprograms. Two graph models, the program graph model, and the VASE graph model, are defined to represent sequential programs and multiprograms. Markings and token simulations are defined on the VASE model. The distribution of conditional logic and the introductions of resource collectors for the distribution of loop logic in sequential programs is discussed. Algorithms are presented for transforming program graph models of structured sequential programs into VASE graph models of sequential programs. Algorithms are presented for analyzing the VASE model and generating VASE graph models of multiprograms. Finally a design process is presented for the generation of concurrent control code skeletons for two forms of physical realization; macromodules and MPL. Dissert. Abstr.

N81-26733 Cornell Univ., Ithaca, N. Y.
ASYMPTOTIC COMPLEXITY OF ITERATIVE COMPUTATIONS Ph.D. Thesis
Robert Christian Melville 1981 95 p
Avail: Univ. Microfilms Order No. 8110948

A synthesis of ideas from the studies of program correctness and asymptotic complexity is proposed concentrating on iterative algorithm in an imperative programming style. Three paradigms, or patterns of reasoning are discussed for the design of efficient algorithms and an algebraic formalization of these techniques is proposed. Incremental updating and deferred updating are reviewed and predicate weakening is introduced. The application of these patterns of reasoning to the invention of several algorithms is demonstrated including: (1) a simulation result for Turing machines where the resource measure is the number of writing operations performed by the machine; (2) a simple data structure for symbol tables with empirical running time much superior to that of balanced trees and worst case time better than the worst case time of hashing; (3) a continuous time/space tradeoff for the problem of in-place permutation of an array; (4) a fast solution to the self crossing problem by a two dimensional Turing machine with an uninitialized workplane. Dissert. Abstr.

N81-26734 Cornell Univ., Ithaca, N. Y.
ON QUERY FORMULATION IN INFORMATION RETRIEVAL Ph.D. Thesis
Harry Chih Chien Wu 1981 160 p
Avail: Univ. Microfilms Order No. 8110915

Various schemes of query formulation in information retrieval are analyzed. It was suggested that query term weights should first increase and then decrease as the document frequencies of the query terms increase. Three term weighting models (utility weights, precision weights, and discrimination value weights) are studied and they all substantiate the suggested behavior. A fourth scheme, the inverse document frequency system, is shown to be a close approximation of the precision system under certain circumstances. Two of the three models require relevance information. The precision and utility weights are based on the occurrence characteristics of the terms in the relevant, as opposed to the nonrelevant, documents in the collection. Methods are suggested for estimating the relevant properties of the terms based on the overall occurrence characteristics in the collection. Experimental evidence indicates that relevance feedback is a most promising strategy. A more general framework which encompasses both the fuzzy set approach and the vector space approach is outlined. Dissert. Abstr.

N81-26735 California Univ., Davis.
ON THE AUTOMATION OF COMPUTATIONAL PHYSICS Ph.D. Thesis
Michael Clarence Wirth 1980 316 p
Avail: Univ. Microfilms Order No. 8112035

Software tools based on the algebraic manipulation system MACSYMA which facilitate the design, analysis, and construction of finite difference programs for the numerical solution of systems of partial differential equations are described. The VECT package performs symbolic algebra and calculus with vectors and dyadics. It includes manipulations of dot and cross products; gradient, divergence, curl, and Laplacian operators; directional derivatives and outer products. The FDIFF package converts scalar, nonlinear partial differential equations into linear, finite difference approximations. It includes tools for discretization of the domain of the PDE dependent variables, linearization of non-linear terms and conversion of derivative terms into finite difference expressions. The FSTAB package automatically performs local Fourier stability analyses on sets of finite difference equations by deriving amplification matrices and eigenvalues. The MACTRAN package converts the finite difference equations and other expressions into FORTRAN code. Dissert. Abstr.

N81-26736 Pittsburg Univ., Pa.
DESIGN OF ABSTRACT DATA STRUCTURES TO FACILITATE STORAGE STRUCTURE SELECTION Ph.D. Thesis
Raymond Franklyn Ford, Jr. 1980 205 p
Avail: Univ. Microfilms Order No. 8112596

A methodology is given for the design of a programming system from a set of abstract types, and for the analysis of the programs written in this system prior to their implementation. The methodology is illustrated with data structures and operations that are commonly used in graph analysis specified using Guttag's algebraic specification system. A set of user operations is derived from the primitive type operators by restricting the language of the primitive operators. This restriction guarantees the correctness of tree transformation operations, and also simplifies the demonstration of various theoretical properties of the abstract type specification. Programs that use the resulting operations are shown to be amendable to analysis that identifies the requirements of a representation for the abstract types. The result of the analysis is a framework to which execution parameters can be added to assist heuristic selection or handcrafting of a representation. Dissert. Abstr.

N81-26737 California Univ., San Francisco.
NATURAL LANGUAGE ACCESS TO CLINICAL DATA BASES Ph.D. Thesis
Martin Nathaniel Epstein 1980 275 p
Avail: Univ. Microfilms Order No. 8111264

The approach followed involves compiling an application language containing both domain specific knowledge about melanoma, and general knowledge about language supporting medical inquiry. A prototype system, MEDINQUIRY, was designed and implemented employing the application language to analyze and process English language requests against the clinical data base. For each request analyzed, it generates a formal query request that is passed to the data base, and provides a revelant response to the submitted inquiry. The system supports dialogue interactions; the user can follow a line of inquiry to test a particular hypothesis by entering a sequence of requests. Phrases rather than complete sentences can be used. The interpretation of the phrase is carried out in the context of prior requests. It is possible to define new constructs at the phrase level, and a limited capability exists, using a sequence of stored requests, to respond to meta-questions. It is also possible to process certain classes of time oriented requests and requests that involve negation. Dissert. Abstr.

N81-26738 Yale Univ., New Haven, Conn.
COMPUTATIONAL GEOMETRY AND CONVEXITY Ph.D. Thesis
Bernard Marie Chazelle 1980 313 p

Avail: Univ. Microfilms Order No. 8110021

The power of convexity as a crucial factor of efficiency in computational geometry is investigated. How nonconvex design can also benefit from this feature is also shown. The problem of finding minimal convex decompositions in two and three dimensions is studied. An O(n + N (3)) dynamic programming algorithm for producing minimal decompositions of nonconvex polygons and an O(nN(3)) heuristics for decomposing three dimensional polyhedra are developed. The problem of finding minimal decompositions in three dimensions is explored and its effective decidability is proved. A class of practical algorithms for detecting intersections of lines, planes, polygons, and polyhedra in two and three dimensions is presented. Their run-times range from O(log n) for the planar cases to O(log cubed n) for detecting the intersection of two polyhedra, where n represents the total number of vertices involved. Dissert. Abstr.

N81-26739 Washington Univ., Seattle.
THREE DIMENSIONAL RECONSTRUCTION OF NEURONS FROM SERIAL SECTIONS Ph.D. Thesis
Michael Lee Dierker 1980 371 p
Avail: Univ. Microfilms Order No. 8111837

A computer-microscope system for the on-line quantification of neuronal structure(s) from single or serial tissue section(s) which results in an accurate numerical representation of the cell is described. A procedure for the serial reconstruction of the brain neurons is presented which allows convenient on-line: (1) section-to-section alignment, and (2) location and identification of processes continuing into adjacent sections. Reconstruction accuracy was verified by comparing tracings of the same cells before and after being sectioned. The system allows the multiple section quantification of three dimensional process structure, cross sectional somal area, process diameter, and spinal and/or varicosital densities. It also permits convenient additional observations on previously quantized structure(s) for easy data-base expansion. Dissert. Abstr.

N81-26740 Illinois Inst. of Tech., Chicago.
A CRASH TOLERANT B-TREE DATA STRUCTURE FOR DATABASE RETRIEVAL SYSTEMS Ph.D. Thesis
James Edward Vandendorpe 1980 130 p
Avail: Univ. Microfilms Order No. 8112428

The programs which update secondary stored B-trees are shown to contain critical paths. If a program crashes while executing within a critical path the B-tree either loses indices or produces duplicated indices that are temporarily inaccessible. It is shown that there is no way to protect the standard B-tree structure from this kind of failure. A B-tree structure is proposed that allows error detection and recovery at negligible cost. The structure differs from the standard B-tree by the inclusion of three additional fields: Median(x); Nephew(x); and Successor(x). The Nephew field is only used as a reference during error detection and is never traversed. The B-tree structure permits timely detection of crash damage and provides enough additional information to restart the update that caused the damage.
Dissert. Abstr.

N81-26741 Cornell Univ., Ithaca, N. Y.
A COMPUTER SYSTEM FOR CHECKING PROOFS Ph.D. Thesis
Scott David Johnson 1981 345 p
Avail: Univ. Microfilms Order No. 8110908

The PL/CV programming logic in which formal proofs of programs can be written and mechanically checked is discussed. The PL/CV logic contains rules for the first order predicate calculus, Peano arithmetic, the theory of equality, and the PL/CS programming language. A Computer system used to check proofs written in PL/CV is described. The correctness of the overall design of the Proof Checker and several of the algorithms employed are argued. The Proof Checker is divided into two modules. The first module is the Local Context Checker (LCC), which inputs a proof and processes it in much the same fashion as a compiler processes a program. But instead of producing machine code, the LCC produces a series of instructions called V-code. The LCC performs checking that only requires examining a small window in the proofs. The global aspects of the proof are represented by the V-code, and are checked by the second module, the V-code Interpreter. Abbreviation rules are built into the LCC and automatic deduction rules are built into the V-code Interpreter that reduce the amount of detail required in proofs.
Dissert. Abstr.

N81-26742 Washington Univ., Seattle.
THE AUTOMATIC GENERATION OF ROBOT TASK SPECIFICATIONS Ph.D. Thesis
Margaret Ann Eastwood 1980 145 p
Avail: Univ. Microfilms Order No. 8111838

An automatic robot task specification method to serve key manufacturing needs is described. The method handles simultaneous goal problems and simplifies growth and maintenance of the task specification system. Parallel planning, the task specification method, handles simultaneous goals by expanding the capabilities of AI's production systems. An example shows that parallel planning solves several blocks-world simultaneous goal problems without backtracking. Execution productions produce plan steps (robot commands), integrate them into a cohesive plan, and monitor all goals throughout the planning process. The class of problems parallel planning solves includes many manufacturing tasks. Aids to the implementor and maintainer address the objective of practicality for manufacturing. Theorems specify necessary conditions for a set of productions to produce valid plans and prescribe control system operation. In addition, computer implementable algorithms verify production set validity and prune sets of productions after their creation or modification. Dissert. Abstr.

N81-26743 Brown Univ., Providence, R. I.
SYSTEM ARCHITECTURE FOR HIGH-PERFORMANCE VECTOR GRAPHICS Ph.D. Thesis
Ingrid Birgitta Carlbom 1980 335 p
Avail: Univ. Microfilms Order No. 8111076

A methodology for the evaluation or for the design of high performance vector graphics systems is presented. The methodology encompasses many aspects of these graphics systems, i.e., hardware architecture, firmware, and software. The methodology is used to evaluate some features of two existing high performance graphics systems. The tradeoffs between functional capabilities and performance in these systems are analyzed, and some of the differences between the systems are illustrated. A hypothetical system is designed, based on analysis of the two systems. Specifically, a set of user instructions and a set of software constructs that combine the functional capabilities of the two existing systems are proposed. An evaluaton of the proposed system indicates that it gives better performance than both of the existing systems for certain classes of applications.
Dissert. Abstr.

N81-26744*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
A STUDY OF SOFTWARE MANAGEMENT AND GUIDELINES FOR FLIGHT PROJECTS Interim Report
9 Apr. 1980 182 p
(Contract NASw-3350)
(NASA-CR-164525) Avail: NTIS HC A09/MF A01 CSCL 09B

A survey of present software development policies and practices, and an analysis of these policies and practices are summarized. Background information necessary to assess the adequacy of present NASA flight software development approaches is presented. T.M.

N81-26745*# National Aeronautics and Space Administration, Washington, D. C.
ALGORITHM AND PROGRAM FOR INFORMATION PROCESSING WITH THE FILIN APPARATUS
L. S. Gurin, V. S. Morkrov, Ye. I. Moskalenko, and K. A. Tsoy Sep. 1979 20 p refs Transl. into ENGLISH of "Algoritm i Programma Obrabotki Informatsii s Probora Filin" Moscow, Rept. Pr-316, 1977 p 1-18 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences, Moscow
(Contract NASw-3198)
(NASA-TM-75704; Pr-316) Copyright. Avail: NTIS HC A02/MF A01 CSCL 09B

The reduction of spectral radiation data from space sources is described. The algorithm and program for identifying segments

of information obtained from the Film telescope-spectrometer on the Salyut-4 are presented. The information segments represent suspected X-ray sources. The proposed algorithm is an algorithm of the lowest level. Following evaluation, information free of uninformative segments is subject to further processing with algorithms of a higher level. The language used is FORTRAN 4. J.D.H.

N81-26746*# Computer Sciences Corp., El Segundo, Calif. Dept. of Engineering Systems.

STREAM TABLE PROGRAM: USER'S MANUAL AND PROGRAM DOCUMENT Final Report

Kathryn H. Hiles May 1981 83 p
(Contract NAS8-31640)
(NASA-CR-161810) Avail: NTIS HC A05/MF A01 CSCL 09B

This program was designed to be an editor for the Lewis Chemical Equilibrium program input files and is used for storage, manipulation and retrieval of the large amount of data required. The files are based on the facility name, case number, and table number. The data is easily recalled by supplying the sheet number to be displayed. The retrieval basis is a sheet defined to be all of the individual flow streams which comprise a given portion of a coal gasification system. A sheet may cover more than one page of output tables. The program allows for the insertion of a new table, revision of existing tables, deletion of existing tables, or the printing of selected tables. No calculations are performed. Only pointers are used to keep track of the data. Author

N81-26747*# Computer Sciences Corp., El Segundo, Calif. Engineering Systems Dept.

TIMELINE RESOURCE ANALYSIS PROGRAM (TRAP): USER'S MANUAL AND PROGRAM DOCUMENT

Jacqueline G. Sessler Jun. 1981 158 p
(Contract NAS8-31640)
(NASA-CR-161812) Avail: NTIS HC A08/MF A01 CSCL 09B

The Timeline Resource Analysis Program (TRAP), developed for scheduling and timelining problems, is described. Given an activity network, TRAP generates timeline plots, resource histograms, and tabular summaries of the network, schedules, and resource levels. It is written in ANSI FORTRAN for the Honeywell SIGMA 5 computer and operates in the interactive mode using the TEKTRONIX 4014-1 graphics terminal. The input network file may be a standard SIGMA 5 file or one generated using the Interactive Graphics Design System. The timeline plots can be displayed in two orderings: according to the sequence in which the tasks were read on input, and a waterfall sequence in which the tasks are ordered by start time. The input order is especially meaningful when the network consists of several interacting subnetworks. The waterfall sequence is helpful in assessing the project status at any point in time. M.G.

N81-26748*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SOFTWARE ENGINEERING STANDARDS AND PRACTICES

Ronald W. Durachka Jun. 1981 49 p
(NASA-TM-82148) Avail: NTIS HC A03/MF A01 CSCL 09B

Guidelines are presented for the preparation of a software development plan. The various phases of a software development project are discussed throughout its life cycle including a general description of the software engineering standards and practices to be followed during each phase. M.G.

N81-26749*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

DETECTION AND MAPPING (DAM) PACKAGE. VOLUME 4A: SOFTWARE SYSTEM MANUAL, PART 1 Final Report, Jan. - Sep. 1980

Edward H. Schlosser Sep. 1980 668 p
(Contract NAS9-15800)
(NASA-CR-161013; LEMSCO-15615-Pt-1; JSC-17024-Pt-1)
Avail: NTIS HC A99/MF A01 CSCL 09B

The package is an integrated set of manual procedures, computer programs, and graphic devices designed for efficient production of precisely registered and formatted maps from digital LANDSAT multispectral scanner (MSS) data. The software can be readily implemented on any Univac 1100 series computer with standard peripheral equipment. This version of the software includes predefined spectral limits for use in classifying and mapping surface water for LANDSAT-1, LANDSAT-2, and LANDSAT-3. Tape formats supported include X, AM, and PM. T.M.

N81-26750*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

DETECTION AND MAPPING (DAM) PACKAGE. VOLUME 4B: SOFTWARE SYSTEM MANUAL, PART 2 Final Report

Edward H. Schlosser Sep. 1980 721 p
(Contract NAS9-15800)
(NASA-CR-161014; LEMSCO-15616-Pt-2; JSC-17024-Pt-2)
Avail: NTIS HC A99/MF A01 CSCL 09B

Computer programs, graphic devices, and an integrated set of manual procedures designed for efficient production of precisely registered and formatted maps from digital data are presented. The software can be used on any Univac 1100 series computer. The software includes pre-defined spectral limits for use in classifying and mapping surface water for LANDSAT-1, LANDSAT-2, and LANDSAT-3. T.M.

N81-26751# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Ocean Science and Technology Lab.

REDUCING LASER PROFILES ON A TABLETOP COMPUTER Final Report

Alan W. Lohanick Feb. 1981 42 p refs
(AD-A098903; NORDA-TN-77) Avail: NTIS HC A03/MF A01 CSCL 09/2

Standard numerical techniques for removing aircraft motion and discontinuities from airborne laser profiles are adapted to a desk-top computer. Because such a computer is much slower than a larger machine, analog active filters replace the numerical (Hamming) filters normally used. The computer programs are in BASIC, and listings are provided in an Appendix. Several examples of data editing procedures are given. Author (GRA)

N81-26752# Wisconsin Univ. - Madison. Mathematics Research Center.

A STABLE THEOREM OF THE ALTERNATIVE: AN EXTENSION OF THE GORDAN THEOREM

O. L. Mangasarian Research Triangle Park, N.C. ARO Mar. 1981 24 p refs
(Contract DAAG29-80-C-0041; Grant NSF MCS-79-01066)
(AD-A099347; MRC-TSR-2185) Avail: NTIS HC A02/MF A01 CSCL 12/1

A theorem with a number of equivalent alternatives is proposed as an extension of the classical Gordan theorem of the alternative. The theorem can handle nonzero unrestricted variables which cannot be directly treated by ordinary theorems of the alternative. Like the Gordan theorem, the extended theorem has the stability feature that small perturbations in the data will not invalidate an alternative that is in force. The theorem has useful applications in establishing the boundedness and uniqueness of feasible points of polyhedral sets and of solutions to linear programming problems. Author (GRA)

N81-26753# Wisconsin Univ. - Madison. Mathematics Research Center.

A DECOMPOSITION METHOD AND ITS APPLICATION TO BLOCK ANGULAR LINEAR PROGRAMS

Cu Duong Ha Jan. 1981 55 p refs
(Contract DAAG29-80-C-0041)
(AD-A099362; MRC-TSR-2174) Avail: NTIS HC A04/MF A01 CSCL 12/1

In this paper, we propose and develop techniques for solving structured, large-scale convex programming problems. The procedure is a combination of a decomposition technique of Dantzig-Wolfe type and the proximal point method. The proximal point method is used to overcome the drawbacks of the decomposition technique. The procedure is then used to solve block angular linear programming problems. By exploiting the linearity of the problem, we have several variants of the procedure. Author (GRA)

N81-26754# California Univ., Los Angeles. Dept. of Computer Science.
ERROR-CODED ALGORITHMS FOR ON-LINE ARITHMETIC Ph.D. Thesis. Final Report
Abdolali Gorji-Sinaki Feb. 1981 230 p refs
(Contract N00014-79-C-0866)
(AD-A098886; UCLA-ENG-8197; CSD-810303) Avail: NTIS HC A11/MF A01 CSCL 09/2

Since on-line arithmetic requires relatively long sequences of operations in order to achieve speed-up over conventional arithmetic, it is important to protect on-line algorithms against hardware failures. If not protected, the hardware failures could quickly contaminant large number of results in progress due to tight coupling of the steps at the digit level. By detecting errors, as they occur, an effective, gracefully degradable organization could be achieved. Namely, error at any step of the algorithms would lead to restriction of precision (significance) of the remaining steps but not catastrophic termination. The main objective of this dissertation is to develop and demonstrate the feasibility of error-coded on-line arithmetic suitable for distributed systems. In this thesis, a set of error-coded on-line algorithms was developed for the four basic operations of addition/subtraction, multiplication and division. Low cost arithmetic error codes (Residue and AN Codes) were found to be suitable for this purpose. Hardware design of the error-coded units at the gate level was considered. A residue-coded on-line division unit was designed based on a already designed digit-slice division unit. A general mathematical model for the cost and speed of the error-coded units was derived and was compared with similar values when no error code is used. Finally, the effectiveness of the proposed detection/correction schemes was considered and proved. Author (GRA)

N81-26755# Connecticut Univ., Storrs. Lab. for Computer Science Research.
DECENTRALIZED SYSTEMS Final Report, 1 Sep. 1979 - 31 Dec. 1980
E. E. Balkovich 31 Dec. 1980 228 p refs
(Contract DASG60-79-C-0117)
(AD-A099195; TR-CS-15-80) Avail: NTIS HC A11/MF A01 CSCL 09/2

Distributed software architectures for decentralized systems are discussed. Specifically, the design of distributed operating systems, extensions to the programming language EPL, and the performance of decentralized software are addressed. M.G.

N81-26756# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
AN ASSESSMENT PROCEDURE AND A SET OF CRITERIA FOR USE IN THE EVALUATING OF COMPUTERIZED MODELS AND COMPUTER-BASED MODELLING TOOLS Final Technical Report
Robert G. Sargent Griffiss AFB, N.Y. RADC Feb. 1981 28 p refs
(Contract F30602-78-C-0083; AF Proj. 5581)
(AD-A098785; WP-80-016; RADC-TR-80-409) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper contains a flexible and adaptive assessment procedure and a set of assessment criteria for use in having assessments conducted of general purpose computerized models and computer-based modelling tools. Basically, the procedure requires the use of a third party to make subjective judgments on a set of criteria specified by the assessment sponsor and to make an overall recommendation on the use of the model or modelling tool. Author (GRA)

N81-26757# Oak Ridge Associated Universities, Tenn.
PREG: A COMPUTER PROGRAM FOR POISSON REGRESSION ANALYSIS
E. L. Frome Mar. 1981 38 p refs
(Contract DE-AC05-76OR-00033)
(ORAU-178) Avail: NTIS HC A03/MF A01

A FORTRAN program is described that computes maximum likelihood estimates for a regression analysis when the dependent variable is a count that follows the Poisson distribution. A detailed description is given the algorithm for maximum likelihood estimation under the Poisson regression model (subroutine PRMLE), three test problems with complete output, and a complete listing of the entire FORTRAN program. The three test problems illustrate Poisson regression with a linear regression model, a log linear regression model, and a nonlinear regression model. This program was developed using FORTRAN 10 on a DEC system 10 computer and was compiled and executed on an IBM 360/ under OS and an IBM 3033 under MVS without any changes in the source code. ANSI standard FORTRAN was used in all program individual user requirements. DOE

N81-26758# Ohio State Univ., Columbus.
SOFTWARE SUPPORT SYSTEM FOR DATA ACQUISITION AND ANALYSIS Final Report, Jul. - Nov. 1979
H. Hemami, S. Wang, and P. Grygier Nov. 1980 53 p refs
(Contract DOT-HS-NHTSA-96606)
(PB81-152688; DOT-HS-805671) Avail: NTIS HC A04/MF A01 CSCL 09B

The development, documentation, and demonstration of a number of computer programs developed for the purpose of conversion and processing of digital data are discussed. There are six programs altogether: a conversion program for digital tapes, a plotting program, a program that computes head injury criterion, a program to compute mean and standard deviation, and finally a program to dump a file from memory. GRA

N81-26759# Foersvarets Forskingsansalt, Stockholm (Sweden).
VIEWDATA-INTERFACE FOR ARBITRARY COMPUTER PROGRAMS
Jacob Palme Jun 1980 11 p In ENGLISH and SWEDISH
(PB81-160350; FOA-C-10153-M6(H9) Avail: NTIS HC A02/MF A01 CSCL 09B

The main algorithms in a computer program for interfacing a viewdata terminal to arbitrary application computer programs are described. The interface handles the problems of partitioning the input and output to/from the application to suit the small and non-scrolling screen of the viewdata terminal. GRA

N81-26760# National Bureau of Standards, Washington, D.C.
VALIDATION, VERIFICATION, AND TESTING OF COMPUTER SOFTWARE Final Report
W. Richards Adrion, Martha A. Branstad, and John C. Cherniavsky Feb. 1981 62 p refs
(PB81-167074; NBS-SP-500-75; LC-80-600199) Avail: NTIS HC A04/MF A01 CSCL 09B

The testing and analysis techniques that can be used to validate software and to instill confidence in the programming product are surveyed. Verification throughout the development process is stressed. Specific tools and techniques are described. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N81-26761 Illinois Inst. of Tech., Chicago.
HIGH SPEED COMPUTER SYSTEMS AS A RESULT OF CONCURRENT EXECUTION OF SEQUENTIAL INSTRUCTIONS Ph.D. Thesis
Nabil Fouad Magid 1980 94 p
Avail: Univ. Microfilms Order No. 8112432

A technique for the virtual elimination of conditional branch instructions is introduced. The technique, called multiple path exploration (MPE), aims at increasing the potential concurrency between program instructions by automatically and dynamically removing procedural dependencies. An algorithm using a binary precedence matrix for the automatic and dynamic detection of data independent instructions is described. This algorithm, when used jointly with the MPE technique, is significantly less complicated than other automatic detection algorithms presented in previous research. The simplification is attributed to the absence of procedural dependency. The algorithm works as well in the case of cycles, and concurrency between different iterations of a cycle can be detected. Dissert. Abstr.

N81-26762 Pittsburg Univ., Pa.
AUTOMATON NETWORKS AND PARALLEL REWRITING SYSTEMS Ph.D. Thesis

John Joseph Grefenstette 1980 191 p
Avail: Univ. Microfilms Order No. 8112600

Formal methods of distributed algorithms, in which the local representatives of the algorithm are represented by finite automata, are studied from both an automata theory and a formal language theory point of view. Automaton networks, compirising finite graphs of bounded degree in which each node contains a copy of a finite state machine, are analyzed and design principles are investigated. Several natural problems concerning the behavior of systems of automaton networks, such as questions about deadlock and synchronization, are shown to be undecidable by relating the automaton network model to well known models in formal language theory. New solutions to the network firing squad problem are presented which show that local automata can be designed which recognize the structure of the network and which use this knowledge to increase the efficiency of solutions to network problems. Repetitive behavior of words in parallel rewriting systems (L Systems) is investigated. Finally, two methods for defining circular or ring-structured parallel rewriting systems are compared. Dissert. Abstr.

N81-26763# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
COMPLEXITY OF COMMUNICATION AMONG ASYNCHRONOUS PARALLEL PROCESSES Technical Report, 1 Sep. 1979 - 14 Jan. 1981
James E. Burns Jan. 1981 72 p
(Contract N00014-79-C-0873; Grants NSF MCS-77-15628; NSF MCS-77-28305)
(AD-A099302; GIT-ICS-81/01) Avail: NTIS HC A04/MF A01 CSCL 09/2

Certain problems of synchronization for systems of processes which execute asynchronously and communicate through shared variables or message passing are explored. Solutions are obtained for deadlock free mutual exclusion and lockout-free mutual exclusion for N processes communicating by shared variables. For systems which communicate by passing messages, a solution to the 'election problem' is presented choosing a single process to become the system controller in an initial configuration of N processes in which no process has any information about the number or the identity of the other processes in the system.
Author (GRA)

N81-26764# Geological Survey, Reston, Va. Water Resources Div.
COMPUTER PROGRAM FOR NETWORK ANALYSIS FOR REGIONAL INFORMATION Final Water-Resources Investigations
Edward J. Gilroy Nov. 1980 47 p refs
(PB81-159345; USGS/WRD/WRI-81/007) Avail: NTIS HC A03/MF A01 CSCL 08H

The computer program MODLVALU is described which enables the designer of a data-collection network to apply the Network Analysis for Regional Information technique of network design based upon a regional regression analysis. The input to MODLVALU consists of (1) the observed standard error of the regional regression of specified distributional characteristics; (2) a probabilistic description of the multivariate population being sampled in terms of joint prior probabilities of the coefficient of variation and cross-correlation coefficient; and (3) the level of data availability. The output of MODLVALU consists of a family of probability distributions of the true standard error of estimate of the regional regression equation. GRA

N81-26765# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
THE NBS COMPUTER NETWORKING PROGRAM
R. Blanc, J. Heafner, R. Rosenthal, and S. Watkins Oct. 1980 23 p refs
(PB81-158255; NBSIR-80-2154) Avail: NTIS HC A02/MF A01 CSCL 05B

Activities in computer network protocols for large global networks, protocol interfaces, and measurement techniques for local area computer networks and work in computer-based office systems are described. These efforts include the development of standards and the performance of the necessary research to support that standards development. Descriptions of the specific products being worked on are included. GRA

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N81-26766# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Md.
PROCEEDINGS OF THE 2ND MEETING OF THE COORDINATING GROUP ON MODERN CONTROL THEORY, PART 1
Apr. 1981 254 p refs Conf. held at Aberdeen Proving Ground, Maryland, 10-11 Dec. 1980
(DA Proj. 1R6-65706-M-541)
(AD-A098948) Avail: NTIS HC A12/MF A01 CSCL 12/1

The application of control theory to various military systems is discussed. Optimal, suboptimal, adaptive, linear, and nonlinear control modes are addressed along with prediction algorithms. Applications include fire control, missile guidance, aircraft motion, and aircraft systems. M.G.

N81-26767# Yale Univ., New Haven, Conn. Dept. of Computer Science.
BORIS: AN EXPERIMENT IN IN-DEPTH UNDERSTANDING OF NARRATIVES
Wendy Lehnert, Michael G. Dyer, Peter N. Johnson, C. J. Yang, and Steve Harley Jan. 1981 86 p refs
(AD-A098965; RR-188) Avail: NTIS HC A05/MF A01 CSCL 09/2

BORIS is a story understanding and question answering system which involves the specification and interaction of many sources of knowledge. Unlike skimmers, which simply extract the gist of a story in a top-down manner and ignore everything else, BORIS attempts to understand everything that it reads to as great a depth as possible. This report focuses on how the BORIS program handles a complex story involving a divorce.
Author (GRA)

N81-26768# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.
ANALYTIC MODELS OF MULTITASK PROCESSES Interim Report
Timothy L. Johnson 1981 8 p refs Proposed for presentation at the 20th IEEE Conf. on Decision and Control, San Diego, Calif., Dec. 1981
(Contract F49620-80-C-0002; AF Proj. 9769)
(AD-A099179; LIDS-P-1085; AFOSR-81-0458TR) Avail: NTIS HC A02/MF A01 CSCL 14/1

Asynchronous multitask processes occur in a wide variety of control applications ranging from industrial control to computer operating systems, yet no analytical methods are available for studying their detailed behavior. The preliminary results reported here illustrate that a very general class of such processes can be represented by discontinuous hybrid-state discrete-time systems. Author (GRA)

N81-26769# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
THE USE OF PARALLELISM TO IMPLEMENT A HEURISTIC SEARCH
William A. Kornfeld Mar. 1981 18 p
(Contract N00014-75-C-0522)
(AD-A099184; AI-M-627) Avail: NTIS HC A02/MF A01 CSCL 09/2

The role of parallel processing in heuristic search is examined by means of an example (cryptarithmetic addition). A problem solver is constructed that combines the metaphors of constraint propagation and hypothesize-and-test. The system is capable of working on many incompatible hypotheses at one time. Furthermore, it is capable of allocating different amounts of processing power to running activities and changing these allocations as computation proceeds. On the average, it is empirically found that the parallel algorithm is more efficient than a corresponding sequential one. Implications of this for problem solving in general are discussed. Author (GRA)

N81-26770# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.
REALIZATION OF A/D AND D/A CODERS
D. G. Wimpey, T. L. Johnson, and M. E. Kaliski (Northeastern Univ., Boston) Apr. 1981 10 p refs Presented at the Joint Automatic Control Conf., Charlottesville, Va., Jun. 1981
(Contract F49620-80-C-0002; AF Proj. 9769)
(AD-A099230; LIDS-P-1084; AFOSR-81-0457TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The notion of a discrete-time coder as a device which converts real vector-valued sequences into sequences over a finite alphabet is formalized. A hierarchical classification of all coders, in terms of their input-output mappings, is sought. This classification is based on a canonical structure theory being developed for coders. An algebraic approach is used to define three classes of coders which have simple canonical realizations, i.e., ones for which known synthesis procedures may be used. It is proposed that coders be viewed as acceptors of real languages, and the hierarchy of the real languages be used in conjunction with the hierarchy suggested by these three coders to achieve a complete classification. Author (GRA)

N81-26771# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.
ON FEEDBACK LAWS FOR ROBOTIC SYSTEMS Interim Report
T. L. Johnson Apr. 1981 7 p refs Proposed for presentation at the 8th IPAC World Congr., Kyoto, Aug. 1981
(Contract F49620-80-C-0002; AF Proj. 9769)
(AD-A099229; LIDS-P-1083; AFOSR-81-0456TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A variety of control problems arising from robotics applications can be restated as optimal control problems of minimum-time state transfer in the presence of state-space constraints and constraints of incomplete-state information. The traditional approaches to solving such problems are Pontryagin's Maximum Principle, in the case of open-loop control, and Bellman's Dynamic Programming method. GRA

N81-26772# Stanford Univ., Calif. Dept. of Computer Science.
VERIFICATION OF LINK-LEVEL PROTOCOLS
Donald E. Knuth Jan. 1981 7 p refs
(Contract N00014-76-C-0330; Grants NSF MCS-77-2378; NSF IST-79-21977)
(AD-A099140; SU-STAN-66-81-840) Avail: NTIS HC A02/MF A01 CSCL 12/1

Stein Krogdahl has given an interesting demonstration of the partial correctness of a 'protocol skeleton' by which the validity of the essential aspects of a large variety of data transmission schemes can be demonstrated. The purpose of this note is to present a simpler way to obtain the same results, by first establishing the validity of a less efficient skeleton and then 'optimizing' the algorithms. The present approach, which was introduced for a particular protocol by N. V. Stenning, also solves a wider class of problems that do not require first-in-first-out transmissions. Author (GRA)

N81-26773# Systems Control, Inc., Palo Alto, Calif. Aeronautical and Marine Systems Div.
PARAMETER INSENSITIVE CONTROL Final Report
Robert L. Kosut Apr. 1981 160 p refs
(Contract N00014-77-C-0247)
(AD-A099141) Avail: NTIS HC A08/MF A01 CSCL 12/1

We developed two linear parameter insensitive controllers, one based on a periodic function of state variables and the other on a linear combination of past states and inputs. Leads and lags used in classical control laws are also special cases of the parameter insensitive controllers suggested by us in the paper. Parameter insensitive controllers and filters presented in this paper extend the structure of controllers for completely known systems to partially known systems in a logical manner. The advantages of our controllers are: (a) they are simple to design and implement, (b) a desired tradeoff may be made between optimality and complexity, (c) the stability properties and stability regions are easily determined, (d) the structure of the controller does not change as long as the parameters vary within the prescribed set, and (e) the controller works well when parameters change relatively fast. A disadvantage is that there is no learning. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-26774 Brown Univ., Providence, R. I.
FOLDINGS AND CRIMPINGS OF ALGEBRAIC VARIETIES Ph.D. Thesis
Kevin John Mitchell 1980 129 p
Avail: Univ. Microfilms Order No. 8111149

A special case of the coequalizer problem in algebraic geometry is examined. Assume k is an algebraically closed field. Let phi: V sub 1 proceed to V sub 2 be an isomorphism of subvarieties of an algebraic variety X. It is then asked, when is there a folding of X obtained by identifying V sub 1 and V sub 2 according to phi. In analogy with Mumford's geometric invariant theory, the notions of categorical and geometric quotients p:x proceeds to Y. Each is unique, when it exists, and p is surjective. The main requirement for a geometric quotient is that p:X proceeds to Y identify the phi-related points of X. A geometric quotient is categorical, but examples show that a categorical quotient need not be geometric. Obstructions to forming quotients include the presence of an infinite orbit of phi-related points. Under mild assumptions, a geometric quotient exists if and only if it can be constructed locally. This leads to an investigation of quotients of affine varieties. In this case, and also in general, the existence of a quotient depends on how V sub 1 and V sub 2 meet. Further results are discussed. Dissert. Abstr.

N81-26775 Brown Univ., Providence, R. I.
KERNEL FUNCTION APPROACH TO THE LEAST SQUARES FINITE ELEMENT METHOD Ph.D. Thesis
Nader Gholi Zamani-Kashani 1980 120 p
Avail: Univ. Microfilms Order No. 8111196

The numerical solution of partial differential equations using a least squares, finite element method is addressed. As a first step, a class of functions with sufficient smoothness properties on an irregular region is constructed. This class is used as an approximating basis for a finite element technique. The model problem considered is the Poisson's equation on a bounded region. With the aide of kernel functions from potential theory, the pointwise convergence of the approximation is established. The method is then applied to the Biharmonic equation. Finally, the so-called Navier's equation is considered (a coupled system of linear elliptic equations which arises naturally in elasticity theory). The close connection between potential theory and the theory of elasticity allows one to prove pointwise convergence in the case of this elliptic system. Several numerical examples are considered which support the theory. Dissert. Abstr.

N81-26776 Wyoming Univ., Laramie.
NORMAL MULTIPLICATIVE DESIGNS WITH AT LEAST THREE REPLICATIONS Ph.D. Thesis
Linda Host-Hammond 1980 55 p
Avail: Univ. Microfilms Order No. 8111604

Various equations describing designs in terms of matrices and other parameters are reviewed. In order for a uniform multiplicative design to exist, the matrix dI + alpha alpha t must pass the Hasse-Minkowski test for congruence to the identify over the rationals. Most of the computations required by the Hasse-Minkowski Theorem are unnecessary and a streamlined version for uniform multiplicative designs is presented. An extensive computer search for feasible sets of parameters was carried out for the case where alpha has exactly three distinct entries, all occurring equally many times. It is concluded that normal multiplicative designs cannot be reducible. Dissert. Abstr.

N81-26777 Cornell Univ., Ithaca, N. Y.
ON FINITE ELEMENT METHODS FOR THE EULER-POISSON-DARBOUX EQUATION Ph.D. Thesis
Anatoly Michael Genis 1981 88 p
Avail: Univ. Microfilms Order No. 8110900

Various convergence estimates are deduced for some semidiscrete and fully discrete procedures which might be used in the approximation of exact solutions of initial boundary value problems with homogeneous Dirichlet boundary conditions for the Euler-Poission-Darboux equation. These procedures include the ordinary Galerkin method based on approximating subspaces with functions vanishing on the boundary of the basic domain as well as certain methods which do not require such restrictions. The results are somewhat analogous to those known for parabolic equations. Maximum norm estimates, L2 estimates, negative norm estimates, interior estimates of difference quotients, and superconvergence estimates are included. Most of the proofs are based on different modifications of an energy method, some of them depend on the Weinstein recursion formulae and on known results for the associated elliptic problem. Dissert. Abstr.

N81-26778*# Iowa State Univ. of Science and Technology, Ames. Dept. of Mathematics.
SYMBOLIC SOLUTION OF LINEAR DIFFERENTIAL EQUATIONS
Robert B. Feinberg and Ronald G. Grooms [1981] 19 p refs (Grant NsG-1538)
(NASA-CR-164522) Avail: NTIS HC A02/MF A01 CSCL 12A

An algorithm for solving linear constant-coefficient ordinary differential equations is presented. The computational complexity of the algorithm is discussed and its implementation in the FORMAC system is described. A comparison is made between the algorithm and some classical algorithms for solving differential equations. M.G.

N81-26779*# Hampton Inst., Va.
STAR ADAPTATION OF QR ALGORITHM
Shantilal N. Shah Jun. 1981 29 p refs
(Contract NCC1-7)
(NASA-CR-165730) Avail: NTIS HC A03/MF A01 CSCL 12A

The QR algorithm used on a serial computer and executed on the Control Data Corporation 6000 Computer was adapted to execute efficiently on the Control Data STAR-100 computer. How the scalar program was adapted for the STAR-100 and why these adaptations yielded an efficient STAR program is described. Program listings of the old scalar version and the vectorized SL/1 version are presented in the appendices. Execution times for the two versions applied to the same system of linear equations, are compared. M.G.

N81-26780*# Hampton Inst., Va.
STAR ADAPTATION OF QR ALGORITHM FOR OVERDETERMINED LINEAR SYSTEMS WITH COMPLEX COEFFICIENTS
Shantilal N. Shah Jun. 1981 26 p Sponsored by NASA
(NASA-CR-165731) Avail: NTIS HC A03/MF A01 CSCL 12A

The QR algorithm to solve overdetermined linear systems with complex coefficients used on a serial computer was adapted to execute efficiently in the Control Data Cyber-203 computer. The development of the vectorized version of the algorithm is described. Execution times for different approaches applied to the same system of linear equations are compared. Program listings of the old scalar version and vectorized versions are presented. M.G.

N81-26781# Wisconsin Univ. - Madison. Mathematics Research Center.
A COMPLETE ANALYSIS OF MODEL NONLINEAR SINGULAR PERTURBATION PROBLEM HAVING A CONTINUOUS LOCUS OF SINGULAR POINTS Summary Report
Nancy Kopell (Northern Univ.) and Seymour V. Parter Jan. 1981 39 p refs
(Contracts DAAG29-80-C-0041; N00014-76-C-0341; Grant NSF MCS-77-03715)
(AD-A096672; MRC-TSR-2165; Rept-404) Avail: NTIS HC A03/MF A01 CSCL 12/1

Singularly perturbed differential equations arise in many applications. Such equations are 'almost' singular because the leading coefficients are small say epsilon. In particular, when epsilon goes to 0 the order of the equation decreases and, in general, the number of prescribed conditions; boundary conditions, initial conditions, etc., also decreases. The theory for such problems, including the development of 'boundary layers' and 'internal layers' is relatively well developed for those cases where the reduced equation is regular. However, when the leading coefficients of the reduced equation have singularities or zeros - so called 'turning points' - one has many new difficulties. GRA

N81-26782# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
A RATIONAL FUNCTIONAL APPROXIMATION FOR THE INTEGRATION POINT IN EXPONENTIALLY WEIGHTED FINITE ELEMENT METHODS Interim Report
Joseph E. Flaherty Mar. 1981 19 p refs Prepared in cooperation with Army Armament Research and Development Command, Watervliet, N.Y.
(Grant AF-AFOSR-0192-80; AF Proj. 9749)
(AD-A098830; AFOSR-81-0447TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A rational function is presented for approximating the function f(z) = coth z - 1/z that appears in several exponentially fitted or weighted finite difference and finite element methods for convection-diffusion problems. The approximation is less expensive to evaluate than f(z) and provides greater accuracy than the doubly asymptotic approximation when z = O(1). Author (GRA)

N81-26783# Naval Postgraduate School, Monterey, Calif.
DETECTION OF A TARGET LEAVING INTERMITTENT TRACES
A. R. Washburn Feb. 1981 16 p refs
(AD-A099115; NPS55-81-007) Avail: NTIS HC A02/MF A01 CSCL 12/1

A target reveals its presence by occasional emission of 'blobs' of material that are temporarily detectable by a searcher moving in the same medium. The main question addressed is 'how long will it take the searcher to detect a blob?' Diffusion of the blobs in two and three dimensions is included as a special case. Author (GRA)

N81-26784# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
DOUBLE FOURIER SERIES SOLUTION OF POISSON'S EQUATION ON A SPHERE Interim Scientific Report
Samuel Y. K. Yee 29 Oct. 1980 19 p refs
(AF Proj. 2310)
(AD-A099385; AFGL-TR-80-0334) Avail: NTIS HC A02/MF A01 CSCL 12/1

Advances in numerical simulation and prediction in disciplines as diverse as geophysical fluid dynamics, heat transfer, and nuclear and plasma physics have generated, in recent years, considerable interest in the method of solution for Poisson-type equations. A method for the solution of Poisson's equation on the surface of a sphere is given. The method makes use of truncated double Fourier series expansions on the sphere and invokes the Galerkin approximation. It has an operation count of approximately 12(J sq)(1 - log sub 2 J) for a latitude-longitude grid containing 2J x (J-1) - 2 data points. Numerical results are presented to demonstrate the method's accuracy and efficiency. Author (GRA)

N81-26785# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
AN ALGEBRAIC APPROACH TO SUPER-RESOLUTION ADAPTATIVE ARRAY PROCESSING
James A. Cadsow and Thomas P. Bronez Apr. 1981 5 p refs
(Contract N00014-80-C-0303)
(AD-A099144) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper, an algebraic characterization is made of the problem of resolving two or more closely spaced (in frequency wave number) plane waves incident on a linear array. This algebraic characterization in turn suggests a number of adaptive procedures for effecting the desired resolution. One of these procedures is herein empirically shown to provide significantly better performance when compared to other contemporary procedures used in array processing such as the Wiener filter, Pisarenko and LML algorithms. This includes both a better frequency resolving capability and a faster convergence rate. GRA

N81-26786# Wisconsin Univ. - Madison. Mathematics Research Center.

MULTIVARIATE SPLINES

Klaus Hoellig Mar. 1981 33 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-79-27062)

(AD-A099350; MRC-TSR-2188) Avail: NTIS HC A03/MF A01 CSCL 12/1

A class of multivariate non tensor product spline functions are introduced. They can be applied to finite element methods, smoothing of data, and surface fitting. L.F.M.

N81-26787# Wisconsin Univ. - Madison. Materials Research Center.

CONTINUITY OF WEAK SOLUTIONS TO A GENERAL POROUS MEDIA EQUATION

Emmanuele DiBenedetto (Indiana Univ.) Research Triangle Park, N.C. ARO Mar. 1981 50 p refs

(Contract DAAG29-80-C-0041)

(AD-A099351; MRC-TSR-2189) Avail: NTIS HC A03/MF A01 CSCL 20/4

The singular parabolic equations treated in this report serve as a model for filtration of fluids in porous media -- in particular, for the filtration of gases. The function serves as the model situation for such problems and makes the equation singular. Usually solutions of boundary value problems associated with such equations are found in a global sense, i.e., they are characterized as equivalence classes in certain Sobolev spaces. It is of interest to decide whether they may be defined pointwise and whether they possess some local regularity such as continuity. In this paper we prove that global (weak) solutions are in fact continuous. Moreover, we study under what circumstances their continuity can be extended up to the boundary of the domain where the process takes place. GRA

N81-26788# Wisconsin Univ. - Madison. Mathematics Research Center.

INTEGRATION OF INTERVAL FUNCTIONS. 2: THE FINITE CASE

L. B. Rall Research Triangle Park, N.C. ARO Mar. 1981 16 p refs Sponsored in part by Danish Natural Science Research Council

(Contract DAAG29-80-C-0041)

(AD-A099352; MRC-TSR-2190) Avail; NTIS HC A02/MF A01 CSCL 12/1

Caprani, Madsen, and Rall have shown previously that the use of interval values leads to a simple theory of integration in which all functions, interval and real, are integrable. Here, a simplified construction of the interval integral is given for the case that the integrand and interval of integration are finite; the interval integral is shown to be the intersection of the interval Darboux sums corresponding to the partitions of the interval of integration into subintervals of equal length. A rate of convergence of these interval Darboux sums to the interval integral is given for Lipschitz continuous integrands. An alternate approach to interval integration in the unbounded case via finite interval integrals is presented. The results give theoretical support to interval methods for the solution of integral equations and finding extreme values of functionals defined in terms of integrals.

Author (GRA)

N81-26789# Wisconsin Univ. - Madison. Mathematics Research Center.

SOME OPTIMAL ERROR ESTIMATES FOR PIECEWISE LINEAR FINITE APPROXIMATIONS

Rolf Rannacher (Erlagen-Nuernberg Univ., West Germany) and Ridgway Scott (Michigan Univ.) Research Triangle Park, N.C. ARO Mar. 1981 15 p refs

(Contract DAAG29-80-C-0041)

(AD-A099353; MRC-TSR-2191) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper concerns error estimates for methods of approximating the solution of a partial differential equation. The method in question is the so-called 'finite element method,' which was developed by structural engineers and is now widely used in all branches of engineering. The paper refines previously derived estimates of the error in 'maximum norm,' i.e., the maximum error (as opposed to an average error). The paper settles certain technical questions as to the rate of convergence of the finite element method in this norm. Author (GRA)

N81-26790# Wisconsin Univ. - Madison. Mathematics Research Center.

MINIMIZATION PROBLEMS IN L1 (R3)

P. L. Lions Research Triangle Park, N.C. ARO Mar. 1981 60 p refs

(Contract DAAG29-80-C-0041)

(AD-A099354; MRC-TSR-2192) Avail: NTIS HC A04/MF A01 CSCL 12/1

In this paper, minimization problems in L1(IR3) are considered. These problems arise in astrophysics for the determination of equilibrium configurations of axially symmetric rotating fluids (rotating stars). Under nearly optimal assumptions a minimizer is proved to exist by a direct variational method, which uses heavily the symmetry of the problem in order to get some compactness. Finally, by looking directly at the Euler equation, we give some existence results (of solutions of the Euler equation) even if the infimum is not finite. Author (GRA)

N81-26791# Wisconsin Univ. - Madison. Mathematics Research Center.

THE BIFURCATION BEHAVIOR OF TUBULAR REACTORS

Klavs F. Jensen and Ray W. Harmon Jan. 1981 94 p refs

(Contract DAAG29-80-C-0041; Grant NSF CPE-79-21510)

(AD-A099360; MRC-TSR-2172) Avail: NTIS HC A05/MF A01 CSCL 12/1

Methods for studying the bifurcation behavior of tubular reactors have been developed. This involves the application of static and Hopf bifurcation theory for PDE's and the very precise determination of steady state profiles. Practical computational methods for carrying out this analysis are discussed in some detail. For the special case of a first order, irreversible reaction in a tubular reactor with axial dispersion, the bifurcation behavior is classified and summarized in parameter space plots. In particular the influence of the Lewis and Peclet numbers is investigated. It is shown that oscillations due to interaction of dispersion and reaction effects should not exist in fixed bed reactors moreover, should only occur in very short 'empty' tubular reactors. The parameter study not only brings together previously published examples of multiple and periodic solutions but also reveals a hitherto undiscovered wealth of bifurcation structures. Sixteen of these structures, which come about by combinations of as many as four bifurcations to multiple steady states and four bifurcations to periodic solutions, are illustrated with numerical examples. Although the analysis is based on the pseudohomogeneous axial dispersion model, it can readily be applied to other reaction diffusion equations such as the general two phase models for fixed bed reactors. Author (GRA)

N81-26792# Wisconsin Univ. - Madison. Mathematics Research Center.

MORSE PROGRAMS: A TOPOLOGICAL APPROACH TO SMOOTH CONSTRAINED OPTIMIZATION

Okitsugu Fujiwara Feb. 1981 23 p refs

(AD-A099364; MRC-TSR-2176) Avail: NTIS HC A02/MF A01 CSCL 12/1

We consider nonlinear constrained optimization problems in which the objective function and constraint functions are sufficiently smooth. We focus on the programs which consist of both equality and inequality constraints, and we prove that the global optimum value function is twice continuously differentiable almost everywhere with respect to the parameters.Author (GRA)

N81-26793# Wisconsin Univ. - Madison. Mathematics Research Center.

INVERSE SUMS OF MONOTONE OPERATORS

Stephen M. Robinson Feb. 1981 13 p refs

(Contract DAAG29-80-C-0041; Grant NSF MCS-79-01066)

(AD-A099365; MRC-TSR-2177) Avail: NTIS HC A02/MF A01 CSCL 12/1

We show that the inverse image of a point under the sum of two monotone operators in R(n) has a special form if a simple condition is imposed on one of the operators. This result is then applied to characterize the form of the solution set of a monotone linear generalized equation. Some known results are recovered as a special case. Author (GRA)

N81-26794# Wisconsin Univ. - Madison. Mathematics Research Center.

L INFINITY-LOWER BOUND OF L2-PROJECTIONS ONTO SPLINES ON A GEOMETRIC MESH

Y. Y. Feng and J. Kozak Feb. 1981 20 p refs

(Contract DAAG29-80-C-0041)

(AD-A099366; MRC-TSR-2178) Avail: NTIS HC A02/MF A01 CSCL 12/1

Least-squares approximation by polynomial splines is a very effective means of approximation, particularly when the knots are appropriately nonuniformly spaced to adapt to the particular behavior of the function being approximated. Unfortunately, the stability of this process has been established only for nearly uniform knot sequences. The stability can be linked to the norm of the inverse of the Gram matrix of a (appropriately scaled) B-spline basis. In an earlier report, we studied an important special case, that of a geometric knot sequence and there showed the norm of the inverse of that Gramian to be bounded independent of the mesh ratio. In the present report, we continue these investigations and show, in particular, the surprising fact that the norm of the inverse of the Gramian is least (i.e., the stability is greatest) when the mesh is most nonuniform.

Author (GRA)

N81-26795# Wisconsin Univ. - Madison. Mathematics Research Center.

MULTIPLE PERIODIC SOLUTIONS FOR AN ASYMPTOTICALLY LINEAR WAVE EQUATION

K. C. Chang, S. P. Wu, and S. Li Feb. 1981 18 p refs

(Contract DAAG29-80-C-0041)

(AD-A099367; MRC-TSR-2179) Avail: NTIS HC A02/MF A01 CSCL 12/1

Two kinds of existence of multiple periodic solutions for an asymptotically linear wave equation are studied. The first concerns the existence of at least three distinct solutions without any group symmetry assumptions on the nonlinear term. The second deals with an estimation of the number of solutions based on the asymptotic behaviour of the nonlinear term at zero and at infinity under an oddness assumption. Author (GRA)

N81-26796# Wisconsin Univ. - Madison. Mathematics Research Center.

SOLVING QUADRATIC PROGRAMS BY AN EXACT PENALTY FUNCTION

Shih-Ping Han (Illinois Univ. at Urbana) Research Triangle Park, N.C. ARO Feb. 1981 35 p refs

(Contract DAAG29-80-C-0041; Grant NSF ENG-79-03881)

(AD-A099368; MRC-TSR-2180) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper we study a gradient projection method for quadratic programs that does not require the generated points to be feasible and can avoid the computation of a feasible starting point. This is done by using an exact penalty function in the line-search. It is shown that the method can produce from any starting point a solution in a finite number of iterations.

Author (GRA)

N81-26797# Wisconsin Univ. - Madison. Mathematics Research Center.

ON A TEST FOR MULTIMODALITY BASED ON KERNEL DENSITY ESTIMATES

B. W. Silverman (Bath Univ., England) Research Triangle Park, N.C. ARO Feb. 1981 19 p refs

(Contract DAAG29-80-C-0041)

(AD-A099369; MRC-TSR-2181) Avail: NTIS HC A02/MF A01 CSCL 12/1

Kernel probability density estimates can be used to construct a test of the hypothesis that the density underlying a given univariate data set has at most k modes, for any given k greater than 1. The test is based on the critical value of the smoothing parameter for k modes to occur in the estimate. The theoretical properties of this test are investigated; the asymptotic properties of the test statistic show that the test is consistent. Furthermore the rate of convergence of the test statistic to zero gives some theoretical insight into a bootstrap technique previously suggested by the author, and also into observed properties of kernel density estimates. Author (GRA)

N81-26798# Maryland Univ., College Park. Inst. for Physical Science and Technology.

SELECTION OF FINITE ELEMENT METHODS

D. N. Arnold, I. Babuska, and J. Osborn Mar. 1981 33 p refs Presented at the Intern. Symp. on Hybrid and Mixed Finite Element Methods, Atlanta, 8-10 Apr. 1981

(Contract N00014-77-C-0623; Grant NSF MCS-78-02851)

(AD-A098831; BN-963) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper concerns principles for the selection of variational discretization methods. The effectiveness of a method is analyzed in terms of the key concepts of approximability and stability which are related to the goals of the computation through a selected norm on the error. The importance of robustness is emphasized and its influence on the selection of methods is analyzed. These concepts are elaborated on through a series of illustrative examples and results. Author (GRA)

N81-26799# Maryland Univ., College Park. Numerical Analysis Lab.

ON A DIMENSIONAL REDUCTION METHOD. 3: A-POSTERIORI ERROR ESTIMATION AND AN ADAPTIVE APPROACH

M. Vogelius (New York Univ., N.Y.) and I. Babuska Nov. 1980 52 p refs

(Contract N00014-77-C-0623; Grant DAAG29-78-G-0177)

(AD-A098893; BN-956) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper analyzes an adaptive approximate approach for solving (n-1)-dimensional boundary value problems by replacing them with systems of equation in n-dimensional space. The discussion shows how to find reliable a-posteriori estimates for the error and how these can also be used in the design of an adaptive strategy. Various numerical examples are presented.

GRA

N81-26800# Maryland Univ., College Park. Inst. for Physical Science and Technology.

AN ERROR ANALYSIS FOR THE FINITE ELEMENT METHOD APPLIED TO CONVECTION DIFFUSION PROBLEMS

I. Babuska and W. G. Szymczak Mar. 1981 45 p refs

(Contract N00014-77-C-0623)

(AD-A098895; BN-962) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper analyzes the finite element method applied to a convection diffusion model problem. Linear elements are used for the trial space. The error is measured in a norm closely related to the L sup P norm. When the test space is composed of linear elements with parabolic upwinding, the method is shown to be optimal when the input data is piecewise smooth -- a condition which is usually observed in practice. Without these smoothness assumptions, the method is shown to be non-optimal, even if the class of test spaces is extended to include any elements which have a shape independent of the mesh size.

Author (GRA)

N81-26801# Maryland Univ., College Park.

ON THE RATES OF CONVERGENCE OF THE FINITE ELEMENT METHOD

Ivo Babuska and Barna A. Szabo Oct. 1980 45 p refs Prepared in cooperation with Washington Univ., St. Louis

(Contract N00014-77-C-0623)

(AD-A098897) Avail: NTIS HC A03/MF A01 CSCL 12/1

The rate of convergence of the finite element method is a function of the strategy by which the number of degrees of freedom are increased. Alternative strategies are examined in the light of recent theoretical results and computational experience. Author (GRA)

N81-26802# Brown Univ., Providence, R. I. Center for Dynamical Systems.

ASYMPTOTIC DISTRIBUTIONS OF SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS WITH WIDE BAND NOISE INPUTS; APPROXIMATE INVARIANT MEASURES Interim Report

Harold J. Kushner 14 Jan. 1981 35 p refs

(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-76; NSF ENG-77-12946; AF Proj. 2304)

(AD-A098814; LCDS-81-2; AFOSR-81-0445TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Let (x superscript epsilon (dot)) be a sequence of solutions to an ordinary differential equation with random right sides (due to input noise (xi superscript epsilon (dot)) and which converges weakly to a diffusion x(dot) with unique invariant measure mu(dot). Let mu(t, dot) denote the measure of x(t), and suppose that mu(t, dot) approaches mu (dot) weakly. The paper shows, under reasonable conditions, that the measures of x superscript epsilon (t) are close to mu (dot) for large t and small epsilon. In applications, such information is often more useful than the simple fact of the weak convergence. The noise xi superscript epsilon (dot) need not be bounded, the pair (x superscript epsilon (dot), xi(dot)) need not be Markovian (except for the unbounded noise case), and the dynamical terms need not be smooth. The discrete parameter case is treated, and several examples arising in control and communication theory are given. GRA

N81-26803# Stanford Univ., Calif. Dept. of Computer Science.

TWO LINEAR-TIME ALGORITHMS FOR FIVE-COLORING A PLANAR GRAPH

David W. Matula, Yossi Shiloach, and Robert E. Tarjan Nov. 1980 24 p refs

(Contracts N00014-76-C-0330; N00014-76-C-0688; Grants NSF MCS-77-23738; NSF MCS-78-26858)

(AD-A098835; SU-STAN-CS-80-830) Avail: NTIS HC A02/MF A01 CSCL 12/1

A sequential processing algorithm using bicolor interchange that five-colors an n vertex planar graph in O(n-squared) time was given by Matula, Marble, and Isaacson. Lipton and Miller used a batch processing algorithm with bicolor interchange for the same problem and achieved an improved O(n log n) time bound. In this paper we use graph contraction arguments instead of bicolor interchange and improve both the sequential processing and batch processing methods to obtain five-coloring algorithms that operate in O(n) time. Author (GRA)

N81-26804# Stanford Univ., Calif. Dept. of Computer Science.

HUFFMAN'S ALGORITHM VIA ALGEBRA

Donald E. Knuth Mar. 1981 7 p refs

(Contract N00014-76-C-0330; Grant NSF MCS-77-23738)

(AD-A099103; SU-STAN-CS-81-841) Avail: NTIS HC A02/MF A01 CSCL 12/1

The well known algorithm of David A. Huffman for finding minimum redundancy codes has found many diverse applications, and in recent years it has been extended in a variety of ways. The purpose of this note is to discuss simple algebraic approach that seems to fit essentially all of the applications of Huffman's method that are presently known. Author (GRA)

N81-26805# Stanford Univ., Calif. Systems Optimization Lab.

CONVERGENCE RATES OF THE ELLIPSOID METHOD ON GENERAL CONVEX FUNCTIONS

Jean-Louis Goffin (McGill Univ., Montreal) Jan. 1981 43 p refs Sponsored in part by the DGES, and SSHRC

(Contracts N00014-75-C-0267; DE-AM03-76SF-0032; DE-AT03-76ER-72018; Grants NSF MCS-76-81259; NSF MCS-79-26009; NSF ECS-80-12974)

(AD-A099291; SU-SOL-81-3) Avail: NTIS HC A03/MF A01 CSCL 12/1

The ellipsoid method is applied to the unconstrained minimization of a general convex function. The method converges at a geometric rate, which depends only upon the dimension of the space but not on the actual function. This rate can be improved somewhat if the function satisfies some Lipschitz-type condition, or if the minimum set has dimension greater than zero. If the ellipsoid entirely contains the optimal set, equating the Steiner polynomial associated to the optimal set, and the volume of the ellipsoid at a given iteration, will give an upper bound on the minimum recorded function value. Author (GRA)

N81-26806# Tennessee Univ., Knoxville. Dept. of Mathematics.

MIXED FINITE ELEMENT METHODS WITH APPLICATIONS TO FLOW WITH OTHER PROBLEMS Annual Report

Max D. Gunzburger 1981 10 p refs

(Grant AF-AFOSR-0083-80; AF Proj. 2304)

(AD-A098881; AFOSR-81-0446TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Substantial results on the use of mixed finite element methods for partial differential eigenvalue problems and for viscous flow problems have been achieved. Both analytical and computational studies have been carried out. The analytical work is concerned with error estimates for the finite element approximations, while the computational efforts consist of implementing these finite element algorithms. Author (GRA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-26807 Virginia Polytechnic Inst. and State Univ., Blacksburg.

A MARKOV CHAIN REPRESENTATION OF CERTAIN SEQUENTIAL TESTS Ph.D. Thesis

William Henry Woodall 1980 189 p

Avail: Univ. Microfilms Order No. 8110483

Methods are presented for determining the characteristics of certain sequential tests by constructing tests for which exact properties can be calculated using the theory of finite Markov chains. The tests considered are closed sequential tests with decision rules based on the successive values of a statistic which is a cumulative sum of independent and identically distributed components. The expressions for these properties is given in closed form when the decision rules remain the same during sampling. Approximations of the upper percentage points and the moments of the decisive sample number are presented. The effects of truncation are investigated and a method is presented which can be used to determine at what stage an untruncated test with given decision rules can be truncated without violating the restrictions on the error probabilities. The Markov chain representation is applied to certain sequential probability ratio tests. Exact two sample rank tests for normal shift alternatives have been constructed using the Markov chain representation. Dissert. Abstr.

N81-26808 Pittsburg Univ., Pa.

CROSS-VALIDATION AND FORMULA ESTIMATES OF THE SHRINKAGE OF THE MULTIPLE CORRELATION COEFFICIENT Ph.D. Thesis

Corenna Craig Cummings 1980 155 p

Avail: Univ. Microfilms Order No. 8112670

The accuracy and variability of four cross validation procedures and eighteen formulas were compared. Random samples were drawn from two populations of real data which were of a nature typically submitted to regression and cross validation procedures. Regression equations were calculated for the samples and cross validation procedures were applied. The values obtained from formula application to the sample parameters were compared to cross validation indices and known population values. Factors considered include: the population value to be estimated; the type of regression used; the concern about the balance between accuracy variability; and whether cross validation is a viable alternative in terms of time and cost. It is concluded that these five factors must be included in each selection of an estimate and that a single estimate cannot be isolated as the recommended one for all situations. Dissert. Abstr.

N81-26809 North Carolina State Univ., Raleigh.

ASYMPTOTIC THEORY OF INSTRUMENTAL VARIABLES IN NONLINEAR REGRESSION Ph.D. Thesis

Jose Francisco Burguete 1980 85 p

Avail: Univ. Microfilms Order No. 8111379

The instrumental variables estimator, the solution of an optimization problem which objective function depends on a system of sample moments is discussed. The system of sample moment equations depends on the parameter of interest and has expectation zero when evaluated at true value. The objective function is some distance function of the sample moments. For data generated according to a system of simultaneous, nonlinear, implicit equations such conditions are found that, the estimator

is strong consistent and asymptotically normally distributed. The null and non-null distribution of the Wald test statistic and analogs of the Lagrange multiplier test statistic likelihood ratio test statistic are derived. Dissert. Abstr.

N81-26810 Oregon State Univ., Corvallis.
PARAMETER ESTIMATION IN STOCHASTIC MULTICOMPARTMENT MODELS WITH DESTRUCTIVE SAMPLING Ph.D. Thesis
Richard Dean McArthur 1981 65 p
Avail: Univ. Microfilms Order No. 8112903

The problem of estimating the means and variances of the rate constants in a stochastic compartmental model were considered when a time series of observations of an individual system cannot be made, and, when exact expressions for the moments of the stochastic model cannot be found. Several estimation procedures are described and compared using simulated experimental data from three different two compartment pharmacokinetic models. The results suggest that the difference between the mean of the stochastic model and the deterministic model evaluated at the means of the rate constants is not very important in the parameter estimation problem. Dissert. Abstr.

N81-26811 Michigan State Univ., East Lansing.
ON SUBORDINATION, SAMPLING THEOREM AND PAST AND FUTURE OF SOME CLASSES OF SECOND-ORDER PROCESSES Ph.D. Thesis
Mohsen Pourahmadi 1980 79 p
Avail: Univ. Microfilms Order No. 8112139

Analytic conditions for subordination of harmonizable and periodically correlated sequences were studied. Sufficient conditions for subordination of harmonizable sequences and a simple counter example showing that these conditions are not necessary are given. In periodically correlated sequences, which is a subclass of harmonizable sequences, necessary and sufficient conditions for subordination, mutual subordination of such processes in terms of their associated multivariate stationary sequences are derived. Admittance of sampling theorem of a q variate stationary process and is relation with the admittance of sampling theorem of its components is considered. The sampling theorem is used to show that if a q variate stationary process admits a sampling theorem, then each of its components will do so. The well known sampling theorems for harmonizable processes is proven by Abreu's theorem. The disk algebra is generalized to a Dirichlet algebra setting by using function algebraic method. Dissert. Abstr.

N81-26812 Yale Univ., New Haven, Conn.
A PENALTY FUNCTION APPROACH TO SMOOTHING LARGE SPARCE CONTINGENCY TABLES Ph.D. Thesis
Jeffrey Stewart Simonoff 1980 111 p
Avail: Univ. Microfilms Order No. 8110542

When the number of observations is approximately equal to the number of cells in a large contingency table, the standard techniques are not applicable. A smoothing technique involving the use of a roughness penalty id proposed to deal with this problem. It is assumed that the table is constructed so that it would be appropriate to smooth the probabilities over cerain pairs of rows and columns; an example of this would be a table with ordered rows and columns, where it would be reasonable to smooth over adjacent rows and columns. Dissert. Abstr.

N81-26813 Michigan State Univ., East Lansing.
MARKOV RANDOM FIELD TEXTURE MODELS Ph.D. Thesis
George Robert Cross 1980 198 p
Avail: Univ. Microfilms Order No. 8112063

A method of generating samples from the binomial model is given followed by a theoretical and practical analysis of its convergence. Examples show how the parameters of the Markov Random Field control the strength and direction of the clustering in the image. The power of the binomial model to produce blurry, sharp, line-like, and blob-like images is demonstrated. Natural texture samples were digitized and their parameters were estimated under the Markov Random Field model. The use of a hypothesis test for an objective assessment of goodness-of-fit under the Markov Random Field model is a key feature of this investigation. Overall, highly random textures fit the model well. Dissert. Abstr.

N81-26814 Southern Methodist Univ., Dallas, Tex.
A GENERALIZATION OF THE LINEAR BANK STATISTIC AND ITS PROPERTIES Ph.D. Thesis
Gary Joseph Ulrich 1980 116 p
Avail: Univ. Microfilms Order No. 8111881

A broad family of populations particularly suited for ordered observation is proposed. These populations, obtained from the generalization of univariate Lehmann populations to the bivariate case, are both mathematically convenient and encompass a wide variety of the kinds of order relationships one might expect to find in real situations. The usefulness of this family for studying the behavior of rank-based measures of association, particularly Kendall's tau is illustrated. Dissert. Abstr.

N81-26815 Texas Univ. at Arlington.
SENSITIVITY STUDIES OF MULTI-SAMPLE TESTS FOR THE NORMAL AND EXPONENTIAL DISTRIBUTIONS Ph.D. Thesis
Mickie Sue Harbin 1980 125 p
Avail: Univ. Microfilms Order No. 8111708

Empirical power studies of selected multisample tests for normality and exponentiality are presented. Fisher's method of combining independent test sttistics are discussed. Three multi-sample tests for normality, the Anderson-Darling, Shapiro-Wilk, and Tiku tests, are described and their respective empirical powers are evaluated. Multi-sample tests for exponentiality are discussed. A multi-sample procedure for discrimination between the normal and exponential distributions based on independent one sample ratio of maximum likelihoods test statistics is presented. The null distribution of the one sample test statistic is approximated using the Johnson system of distributions. A time-delay inspection procedure which extends the notion of warning regions and utilizes feedback in the sense that the time of the next inspection depends on the present state of the process was developed. The range of the quality characteristics is divided into k levels of acceptance and q levels of rejection. The inspection scheme is formulated as an aperiodic recurrent Markov process. These properties are used in the selection of optimal time delay inspection plans. Dissert. Abstr.

N81-26816 Cornell Univ., Ithaca, N. Y.
ON THE COMPARISON OF MEANS FROM POPULATIONS WITH UNEQUAL VARIANCES Ph.D. Thesis
Barbara Ann Grimes 1981 82 p
Avail: Univ. Microfilms Order No. 8110865

More than two independent sample means arising from populations with unequal variances were compared. The problem of comparing independent sample means arising from populations with unequal variences, the Behrens-Fisher problem, has been under consideration for many years for the case of two populations. The asymptotic normality of the four tests is also demonstrated. The size and power of the proposed tests for various situations of variance and sample size imbalance using numerical analytic techniques were also studied. The supposed significance level at which each test is performed is not the actual significance level of the test. It is concluded that the range of variance and sample size imbalance situations is always conservative, especially when the sample sizes are small. The tests based on b1 and b2 are liberal. The test based on b1 does control the actual size close to the supposed nominal level except when small unequal sample sizes are used with the more variable population being the less sampled. Dissert. Abstr.

N81-26817*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DECENTRALIZED CONTROL OF MARKOVIAN DECISION PROCESSES: EXISTENCE SIGMA-ADMISSABLE POLICIES
Arnold Greenland (George Mason Univ.) Aug. 1980 19 p refs
(NASA-TM-82108) Avail: NTIS HC A02/MF A01 CSCL 12A

The problem of formulating and analyzing Markov decision models having decentralized information and decision patterns is examined. Included are basic examples as well as the

mathematical preliminaries needed to understand Markov decision models and, further, to superimpose decentralized decision structures on them. The notion of a variance admissible policy for the model is introduced and it is proved that there exist (possibly nondeterministic) optional policies from the class of variance admissible policies. Directions for further research are explored. M.G.

N81-26818# Maryland Univ., College Park.
INCOMPLETE AND FALSE IDENTIFICATION DISTRIBUTIONS: GROUP SCREENING MODELS
Samuel Kotz and Norman L. Johnson (North Carolina Univ. at Chapel Hill) May 1981 11 p refs
(Contract N00014-81-K-0301; Grant NSF MCS-80-21704)
(AD-A099310) Avail: NTIS HC A02/MF A01 CSCL 12/1

The authors previously derived the distribution of the number of items observed to be defective in samples from a finite population, when false identification of defectives as well as incomplete identification is taken into account. The corresponding distributions of waiting times until a specified number of defective items is observed were also obained. In the present paper, we extend some of these results to the case of group screening sampling schemes. GRA

N81-26819# Wisconsin Univ. - Madison. Mathematics Research Center.
EXTENSIONS OF RESULTS OF PARDOUX ON STOCHASTIC PARTIAL DIFFERENTIAL EQUATIONS OF FILTERING
Daniel Ocone Jan. 1981 20 p refs
(Contract DAAG29-80-C-0041; Grant NSF MCS-79-27062)
(AD-A099356; MRC-TSR-2168) Avail: NTIS HC A02/MF A01 CSCL 12/1

Pardoux's results on the Zakai equation for nonlinear filtering are extended to cover the case of estimating a signal modified by a potential term. This is applied to state a rigorous Zakai equation for certain filtering problems involving signals with entrance boundaries. GRA

N81-26820# Ohio State Univ., Columbus. Dept. of Statistics.
ENTROPY-BASED RANDOM NUMBER EVALUATION
Edward J. Dudewicz, Edward C. vanderMeulen, M. G. SriRam, and K. W. Teoh Apr. 1981 7 p refs
(Contract N00014-78-C-0543; NR Proj. 042-403)
(AD-A099397; TR-232) Avail: NTIS HC A02/MF A01 CSCL 12/1

Recent work has shown how to test a simple hypothesis of uniformity on the interval (0, 1) by using estimates of entropy. In this paper we use Monte Carlo methods to extend previous tables of critical points and power for such entropy tests to the large sample sizes likely to be desirable when evaluating the output of one or more random number generators. A comparison with asymptotic critical points and power is made. The results are used to evaluate a number of commonly used random number generators. At least one random number generator judged 'good' by the spectral test (multiplier 5**15) is found unsuitable for use. Author (GRA)

N81-26821# Ohio State Univ., Columbus. Dept. of Statistics.
ROBUST SELECTION PROCEDURES BASED ON VECTOR RANKS
Young Jack Lee and Edward J. Dudewicz Apr. 1981 39 p refs Sponsored in part by Army Research Office
(Contract N00014-78-C-0543; NR Proj. 042-403)
(AD-A099398; TR-233) Avail: NTIS HC A03/MF A01 CSCL 12/1

We have studied mathematical properties of the vector rank procedure when applied to selecting the largest location parameter in randomized block models. Even if the data is not quantitative but ordinal, or is not from a location model but from a stochastically ordered family of distributions, the vector rank procedure is applicable. An important competing selection procedure is based on the robust estimate of location parameters (Sen and Puri (1972)). The selection procedure based on robust location estimates does not have the LFC difficulty that the vector rank procedure suffers from, and its relative efficiency compared to the means procedure is that of the Mann-Whitney-Wilcoxon test versus the t-test. A serious disadvantage, however, is that the robust location estimate method is not applicable if the data is ordinal or from a nonlocation family: for example, see Lee and Dudewicz (1980) where the data is incomplete rank order scores or Lee (1980) where the distributional origin of the data is not known. GRA

N81-26822# North Carolina Univ. at Chapel Hill.
ACCELERATED ACCURACY IN THE SIMULATION OF MARKOV CHAINS
George S. Fishman Jan. 1981 45 p refs
(Contract N00014-76-C-0302)
(AD-A099287; TR-81-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper describes a method of obtaining results from the simulation of a finite state positive recurrent aperiodic Markov chain at a cost considerably below the cost required to achieve the same accuracy with pure random sampling. By reorganizing k independent epochs or tours simulated serially into k replications simulated in parallel, one can induce selected joint distributions across replications that produce the cost-saving benefits. The joint distributions follow from the use of rotation sampling, a special case of the antithetic variate method. For a finite state nearest neighbor chain the paper shows that even for independent parallel replications the cost of achieving a specified accuracy with serial simulation relative to the cost for parallel simulation has a lower bound O sq. rt. of k as k approaches infinity. When rotation sampling is used this bound is O(k squared/(1n k) cubed). This lower bound also holds for the more general finite state chains. A simulation of the M/M/1 queueing model with finite capacity n is used to illustrate the effectiveness of the technique for selected values of k, n and activity level rho.
Author (GRA)

N81-26823# Wisconsin Univ. - Madison. Mathematics Research Center.
ON POLYNOMIAL INTERPOLATION IN THE POINTS OF A GEOMETRIC PROGRESSION, STIRLING, SCHELLBACH, RUNGE AND ROMBERG
I. J. Schoenberg Jan. 1981 25 p refs
(Contract DAAG29-80-C-0041)
(AD-A099361; MRC-TSR-2173) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is very well known Newton's interpolation series with divided differences simplifies considerably in the case that we interpolate in the points of an arithmetic progression. It seems much less known that a similar simplification occurs in the case when the points of interpolation form a geometric progression. We describe here the practically forgotten work of Stirling (1730), Schellbach) (1864), and Runge (1981), and its connection with the elegant and more recent algorithm of Romberg (1955).
Author (GRA)

N81-26824# Missouri Univ. -Rolla. Dept. of Statistics.
THE ESTIMATION OF P(X < Y) FOR DISTRIBUTIONS USEFUL IN LIFE TESTING
Asit P. Basu Sep. 1980 25 p refs
(Contract N00014-78-C-0655)
(AD-A099427; TR-98) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper the reliability function R = P(X less than Y) has been estimated when X and Y follow gamma, exponential or bivariate exponential distributions. The paper is partly expository. Author (GRA)

N81-26825# Missouri Univ. -Columbia. Dept. of Statistics.
IDENTIFIABILITY PROBLEMS IN THE THEORY OF COMPETING AND COMPLEMENTARY RISKS: A SURVEY
Asit P. Basu Aug. 1980 29 p refs
(Contract N00014-78-C-0655)
(AD-A099428; TR-97) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this expository paper the concepts of competing and complementary risks are defined and a survey of recent results in the area is presented. Identifiability of distributions, both univariate and multivariate, useful in reliability and survival analysis is considered. Author (GRA)

N81-26826# California Univ., Berkeley. Statistical Lab.
LANGEVIN EQUATIONS WITH POISSON PERTURBANCES

Oleg K. Zakusilo (Kiev Univ., USSR) 21 Jan. 1981 24 p refs
(Contract N00014-75-C-0159)
(AD-A099286; CU-SL-81-02-ONR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Let z(t) epsilon R(n) be a generalized Poisson process with parameter delta. In the present paper, the conditions of existence and limiting behavior as delta approaches infinity or as delta approaches 0 of the stationary distribution of the solution of Langevin equation d sub x(t) = Ax(t)-dz(t) are investigated. Using these results, the distribution of virtual waiting time in a queueing system with variable service speed is studied. Author (GRA)

N81-26827# California Univ., San Diego. Dept. of Mathematics.
RANDOM TIME PROCESSES Final Report, 1 Jan. 1975 - 31 Mar. 1981
Murray Rosenblatt 1 May 1981 7 p refs
(Contract N00014-75-C-0428)
(AD-A099045) Avail: NTIS HC A02/MF A01 CSCL 12/1

Spline estimates of probability density functions were considered and the asymptotic bias and variance of these estimates were determined. Bispectral estimates were employed as a means of getting information about aspects of the nonlinear transfer of energy in turbulence. The behavior of k-dimensional kernel density (probability) estimates and the asymptotic behavior of partial sums of dependent random variables were examined. The relationship between long-range dependence and non-Gaussian structure of the limiting distributions was determined in some cases. GRA

N81-26828# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
ESTIMATION OF THE FAILURE RATE: A SURVEY OF NONPARAMETRIC METHODS. PART 1: NON-BAYESIAN METHODS
Nozer D. Singpurwalla and Man-Yuen Wong 10 Jul. 1980 42 p refs
(Contracts N00014-77-C-0263; DAAG29-80-C-0067; NR Proj. 042-372)
(AD-A099430; SERIAL-T-422) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper several nonparametric, non-Bayesian methods for estimating the failure rate function on which no monotonicity conditions have been imposed are surveyed. The survey attempts to consolidate and synthesize literature from several diverse areas of application, and endeavors to be as up-to-date as is feasible. Author (GRA)

N81-26829# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
NONPARAMETRIC ESTIMATION AND GOODNESS OF FIT TESTING OF HYPOTHESES FOR DISTRIBUTIONS IN ACCELERATED LIFE TESTING
Moshe Shaked and Nozer D. Singpurwalla 25 Jul. 1980 26 p refs
(Contracts N00014-77-C-0263; DAAG29-80-C-0067; Grant NSF MCS-79-27150)
(AD-A099431; SERIAL-T-425) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper we present a nonparametric approach to accelerated life testing by deleting the requirement that the common parametric family of life distributions under all the stresses be specified in advance. We do retain the requirement that the time transformation function be specified, and consider a version of the familiar inverse power law. We show how the data from the accelerated life test can be used to obtain a consistent estimate of the failure distribution at use conditions stress, and test the hypotheses that the underlying failure distributions belong to a specified family of distributions. We also show how to obtain approximate uniform confidence bounds for the failure distribution at use conditions stress. We illustrate our approach by considering some real life data. Author (GRA)

N81-26830# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
FOURIER INTEGRAL ESTIMATE OF THE FAILURE RATE FUNCTION AND ITS MEAN SQUARE ERROR PROPERTIES
Nozer D. Singpurwalla and Man-Yuen Wong 14 Mar. 1980 32 p refs
(Contracts N00014-77-C-0263; DAAG29-80-C-0067; NR Proj. 042-372)
(AD-A099432; SERIAL-T-416) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper we introduce a new class of estimators of the failure rate function which are based on its Fourier transform. We show that these estimators are in fact kernel estimators based on the sinc function. They have, for a certain class of the failure rate functions a faster rate of convergence of the mean square error than those estimators based on other kernels. We attempt to explain the reason for this fast rate of convergence by pointing out the connection between a sinc kernel estimator and the jackknifing of kernel estimators. We make some concluding remarks on the meaning and the value of the results given in this paper. Author (GRA)

N81-26831# Bendix Corp., Kansas City, Mo. Statistical Section.
APPLICATIONS OF THE BIVARIATE NORMAL DISTRIBUTION
B. J. Neal Oct. 1980 12 p refs Presented at the 35th Ann. Quality Congr. and Exposition, San Francisco, 27-29 May 1981 Submitted for publication
(Contract DE-AC04-76DP-00613)
(BDX-613-2319; CONF-810503-1) Avail: NTIS HC A02/MF A01

The application of the bivariate normal distribution in solving certain types of industrial problems involving two variable measurements is examined. Three examples are given illustrating its use in developing a product screening procedure, establishing a prediction model, and handling, testing, and measuring errors. DOE

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N81-26832 California Univ., Los Angeles.
ANALYSIS OF PERTURBED DYNAMIC SYSTEMS UNDER PARAMETER UNCERTAINITY: A NONLINEAR PROGRAMMING APPROACH WITH APPLICATIONS TO MARINE ECOSYSTEMS Ph.D. Thesis
Charles Allen Atkinson 1980 198 p
Avail: Univ. Microfilms Order No. 8111209

A class of applied ecosystem problems are modeled as nonlinear programs (NLP's) and solved using efficient NLP computational procedures. These problems involve interacting multispecies fish populations, one or more of which was perturbed from some known state via increased fishing pressure, or other man-induced or natural phenomena. Critical ecosystem response characteristics and optimum management strategies are generally of interest. The NLP modeling approach is shown to have substantial advantages for treating complex ecosystems and, in particular, for dealing with the practical issue of parameter uncertainty in the dynamics modeling. Dissert. Abstr.

N81-26833 Pittsburg Univ., Pa.
IDENTIFICATION OF LINEAR DISCRETE DYNAMIC SUBSYSTEMS Ph.D. Thesis
Chang Eun Kim 1980 248 p
Avail: Univ. Microfilms Order No. 8112700

The identification problem for linear discrete dynamic subsystems is studied. The objective is to establish a foundation for the solution of the general subsystem identification problem in such a way that the results can be applied to the distributed identification or estimation of a large scale system. The problem is formulated for several classes of systems by specifying for each class: the study subsystem the model structure, the experimental condition (the residual system, interconnection structure and external input condition), and the identification method. The main efforts are directed towards investigating the identifiability condition (especially for deterministic subsystems)

and determining a consistent identification technique (especially for stochastic subsystem). Dissert. Abstr.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N81-26834 Pittsburg Univ., Pa.
MULTIVARIABLE ONE AND TWO-DIMENSIONAL PADE APPROXIMATION THEORY AND ITS APPLICATIONS Ph.D. Thesis
Sankar Basu 1980 131 p
Avail: Univ. Microfilms Order No. 8112695

The scalar one variable and two variable Pade approximation schemes were extended to the matrix case with the objective of using these results in system theory problems. Conditions for existence and uniqueness of the approximations were given and recursive schemes for their computation were developed. A simple criterion to test for bounded-input-bounded-output stability of the approximants in terms of input data was given. Matrix counterparts of the classical results on orthogonal polynomials were developed. A special type of series, namely the matrix Stieltjes series, is introduced and it is shown that Pade approximants of certain order to a matrix Stieltjes series can be synthesized as multiports using resistors, capacitors, and possibly transformers. Dissert. Abstr.

N81-26835 Kansas Univ., Lawrence.
POWER SERIES OVER VON NEUMANN REGULAR RINGS Ph.D. Thesis
John Jaeger Watkins 1980 76 p
Avail: Univ. Microfilms Order No. 8111760

Von Neumann regular rings have a natural partial order where a is less than or equal to b if ab = a squared. Many stability questions for power series rings can be answered in terms of completeness properties of this partial order. Necessary and sufficient conditions are given on a von Neumann regular ring in order that the power series ring will have weak global dimension one. Surprisingly, this is equivalent to the power series ring being Bezout, so this property is characterized as well. It is then shown that the power series ring is coherent (equivalently semihereditary) if and only if every countable chain in the partial order on R has a least upper bound in R. Since a ring is semihereditary if and only if its weak global dimension is less than or equal to one and its minimal prime spectrum is compact, a characterization is given for those von Neumann regular rings for which the power series rings has compact minimal prime spectrum, and this is shown to be equivalent to the total quotient ring of R(X) being von Neumann regular. Dissert. Abstr.

N81-26836 Yale Univ., New Haven, Conn.
THE K PATHS PROBLEM Ph.D. Thesis
George Allen Cypher 1980 99 p
Avail: Univ. Microfilms Order No. 8110026

The k paths problem is examined which asks whether it is possible to find k edge disjoint paths joining k given pairs of vertices in a graph. It is shown that under certain conditions it is possible to solve this problem in polynomial time. Conditions which will guarantee that the k desired paths can always be found are discussed. Upper and lower bounds are presented in terms of the connectivity of the graph. It is shown that if the input is restricted to 2k-3 connected graphs, then polynomial algorithms exist for any fixed k. It follows from this result that under the same restriction, the edge disjoint subgraph homomorphism problem can be solved in polynomial time for pattern graphs with k edges, where k is fixed. Dissert. Abstr.

N81-26837 Brown Univ., Providence, R. I.
WEBS, ABELIAN EQUATIONS, AND CHARACTERISTIC CLASSES Ph.D. Thesis
David Burritt Damiano 1980 104 p
Avail: Univ. Microfilms Order No. 8111093

The Abelian equations of the exception web, the unique non-linearizable quadrilateral web in R(n), are classified. A direct relationship is obtained between the occurences of the dilogarithm in the work of Gabrielov, and Losik, and as an Abelian equation for the exceptional web in the plane. Theorems are proved which state that (1) the exceptional web is of maximum rank, and (2) every Abelian equation for the exceptional web is a linear combination of a combinatorial equation and the Euler Abelian equation. The theorems are applied to the exceptional web in the plane. Dissert. Abstr.

N81-26838 Cornell Univ., Ithaca, N. Y.
ESTIMATION OF THE POSTERIOR DENSITY OF A LOCATION PARAMETER Ph.D. Thesis
Constantine Achilleos Gatsonis 1981 71 p
Avail: Univ. Microfilms Order No. 8110864

The problem of Bayesian inference about an unknown p-variate normal mean theta, with known covariance matrix A, when the prior knowledge about theta is vague is considered. A number of different considerations suggest placing a uniform prior on theta and then calculating a formal posterior. However, in higher dimensions, uniform priors lead to posteriors which provide inadmissible point estimators and confidence procedures. The estimation of the posterior density function is emphasized. The loss function is given by the squared L sub 2 distance between the true posterior density and an estimate of it (Hellinger distance is also used in some cases). The risk is calculated with respect to the marginal density of X. Dissert. Abstr.

N81-26839# Wisconsin Univ. - Madison. Mathematics Research Center.
ON A HYPERBOLIC SYSTEM OF CONSERVATION LAWS WHICH IS NOT STRICTLY HYPERBOLIC
Tai-Ping Liu (Maryland Univ.) and Ching-Hua Wang (New York Univ.) Research Triangle Park, N.C. ARO Mar. 1981 18 p refs
(Contract DAAG29-80-C-0041)
(AD-A099346; MRC-TSR-2184) Avail: NTIS HC A02/MF A01 CSCL 12/1

We study a system of quasilinear hyperbolic conservation laws which is hyperbolic but not strictly hyperbolic. Such systems arise naturally in continuum mechanics such as elastic, multiphase flows. We are interested mainly in the large time behavior of the solution. Due to the nonlinearity of the system and the entropy condition, solutions converge to very simple elementary waves. Nonstrict hyperbolicity of the system may cause stronger nonlinear interactions between waves pertaining to different families; in particular, such interactions may regularize linear waves in the solution. The solutions are constructed using the random choice method. Author (GRA)

N81-26840# Wisconsin Univ. - Madison. Mathematics Research Center.
RESOLVENT FORMULAS FOR A VOLTERRA EQUATION IN HILBERT SPACE Technical Summary Report
Ralph W. Carr (Saint Cloud State Coll.) and Kenneth B. Hannsgen (Virginia Polytechnic Inst. and State Univ., Blacksburg) Jan. 1981 51 p refs
(Contract DAAG29-80-C-0041; Grant NSF MCS-77-28436)
(AD-A099355; MRC-TSR-2167) Avail: NTIS HC A04/MF A01 CSCL 12/1

The resolvent formula for a nonhomogeneous Volterra integrodifferential equation enables one to study the behavior of solutions of the equation for large values of the time variable in terms of general properties of the forcing terms in the equation. This technique depends on having 'good' a priori estimates obtained for the resolvent kernel. When the solution takes its values in a Hilbert space, the resolvent kernel is a function whose values are operators on that space. It is important to know whether the norm of the resolvent kernel (or of its derivative) is integrable on 0, infinity. For a class of equations which includes linear models for the dynamics of viscoelastic materials, we develop sufficient conditions for the derivative of the resolvent kernel to be integrable. Results of this study and certain resolvent formulas can be used to study the asymptotic behavior of the solution y(t, x, f) as t approaches infinity. An application to a semilinear integro-partial differential equation is presented. GRA

N81-26841# Wisconsin Univ. - Madison. Mathematics Research Center.
MORSE PROGRAMS: A TOPOLOGICAL APPROACH TO SMOOTH CONSTRAINED OPTIMIZATION

Okitsugu Fujiwara Research Triangle Park, N.C. ARO Jan. 1981 38 p refs
(Contract DAAG29-80-C-0041; Grants NSF ENG-78-25182; NSF SOC-77-03277)
(AD-A099357; MRC-TSR-2169) Avail: NTIS HC A03/MF A01 CSCL 12/1

We consider nonlinear constrained optimization problems whose objective and constraint functions are sufficiently smooth. No convexity is assumed. Our basic tools are from differential topology. We show that these problems can be reduced to the study of minimizing a Morse function on a manifold with boundary and we give the geometrical meaning to the first order conditions, the second order sufficiency conditions, and strict complementary slackness condition. Our main concerns are the second order sufficiently conditions, sensitivity analysis, generic properties of smooth nonlinear programs, global duality, local uniqueness, and strict complementary slackness. Author (GRA)

N81-26842# Wisconsin Univ. - Madison. Mathematics Research Center.
A GENERALIZATION OF THE LERAY-SCHAUDER INDEX FORMULA Technical Summary Report
J. Sylvester Jan. 1981 22 p refs
(Contract DAAG29-80-C-0041; Grant NSF MCS-79-27062)
(AD-A099363; MRC-TSR-2175) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper generalizes the Leray-Schauder index formula to the case where the inverse image of a point consists of a smooth manifold, assuming some nondegeneracy condition is satisfied on the manifold. The result states that the index is the Euler characteristic of a certain vector bundle over the manifold. Under slightly stronger nondegeneracy conditions, the index is in fact the Euler characteristics of the manifold. The paper also includes a discussion of the Euler characteristic for vector bundles and a simple proof of the Gauss-Bonnet-Chern theorem. Author (GRA)

N81-26843# Los Alamos Scientific Lab., N. Mex.
NONLINEAR SEMIGROUP THEORY FOR SYSTEMS
G. H. Pimbley 1981 15 p refs Presented at the Pomona Coll. Res. Conf., Claremont, Calif., 10-11 Jan. 1981 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-81-488; CONF-810128-1) Avail: NTIS HC A02/MF A01

The abstract Cauchy problem in a B-space is considered. Under certain conditions, and with use of the Generation Theorem of Crandall and Liggett, the finite difference problem has a unique solution on (0,infinity). The application of the Crandall-Liggett theorem is extended to two conservation laws with linear coupling. DOE

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N81-26844*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW TECHNIQUE FOR THE DIRECT MEASUREMENT OF CORE NOISE FROM AIRCRAFT ENGINES
Eugene A. Krejsa 1981 25 p refs Presented at the 17th Joint Propulsion Conf., Colorado Springs, 27-29 Jul. 1981; cosponsored by the AIAA, SAE, and ASME
(NASA-TM-82634; E-859) Avail: NTIS HC A02/MF A01 CSCL 20A

The core noise levels from has turbine aircraft engines were measured using a technique which requires that fluctuating pressures be measured in the far field and at two locations within the engine core. The cross spectra of these measurements are used to determine the levels of the far-field noise that propagated from the engine vore. The technique makes it possible to measure core noise levels even when other noise sources dominate. The technique was applied to signals measured from an Avco Lycoming YF102 turbofan engine. Core noise levels as a function of frequency and radiation angle were measured and are presented over a range of power settings. A.R.H.

N81-26845*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.
NOISE AND PERFORMANCE OF PROPELLERS FOR LIGHT AIRCRAFT
G. P. Succi, D. H. Munro, J. A. Zimmer, P. D. Dunbeck, E. E. Larabee, K. U. Ingard, and J. L. Kerrebrock Jun. 1981 26 p refs
(Contract NAS1-15154)
(NASA-CR-165732) Avail: NTIS HC A03/MF A01 CSCL 20A

The aerodynamic and acoustics of lightly loaded propellers with subsonic tip speed were studied theoretically in order to gain insight into the sound generation of moving bodies. The effect of variation of some parameters such as blade sweep, radial load distribution, and blade number on the nose characteristics of propeller models was also examined. A linear acoustic formula of Succi for noise calculations was coded for a computer and the predicted noise spectra and signatures compared very well with the measured data for model propellers. On the basis of theoretical analysis and model tests, a two bladed fixed pitch propeller was designed for a single engine aircraft. Some flight tests also were performed on this full scale propeller. The peak sound level during a full power flyover at 305 m (1000 ft) altitude was 4.8 dBA lower. A.R.H.

N81-26846*# Wyle Labs., Inc., El Segundo, Calif.
STATIC TESTS OF EXCESS GROUND ATTENUATION AT WALLOPS FLIGHT CENTER Final Report
Louis C. Sutherland and Ron Brown Jun. 1981 155 p refs
(Contract NAS1-15845)
(NASA-CR-3435; WR-80-32) Avail: NTIS HC A08/MF A01 CSCL 20A

An extensive experimental measurement program which evaluated the attenuation of sound for close to horizontal propagation over the ground was designed to replicate, under static conditions, results of the flight measurements carried out earlier by NASA at the same site (Wallops Flight Center). The program consisted of a total of 41 measurement runs of attenuation, in excess of spreading and air absorption losses, for one third octave bands over a frequency range of 50 to 4000 Hz. Each run consisted of measurements at 10 locations up to 675 m, from a source located at nominal elevations of 2.5, or 10 m over either a grassy surface or an adjacent asphalt concrete runway surface. The tests provided a total of over 8100 measurements of attenuation under conditions of low wind speed averaging about 1 m/s and, for most of the tests, a slightly positive temperature gradient, averaging about 0.3 C/m from 1.2 to 7 m. The results of the measurements are expected to provide useful experimental background for the further development of prediction models of near grazing incidence sound propagation losses. A.R.H.

N81-26847# Douglas Aircraft Co., Inc., Long Beach, Calif.
YC-15 INTERIOR NOISE MEASUREMENTS. TECHNICAL DISCUSSION Final Report, 8 May - 8 Dec. 1976
James L. Warnix and D. E. Hines Mar. 1981 123 p refs
(Contract F33657-72-C-0833; AF Proj. 1367)
(AD-A098788; MDC-J7191; AFFDL-TR-76-140) Avail: NTIS HC A06/MF A01 CSCL 20/1

Tests were conducted to simultaneously measure exterior fuselage noise, structural vibration, and interior noise of a YC-15 Advanced Medium-Range Short-Takeoff and Landing Transport airplane that employs an under-the-wing, externally-blown-flap powered lift system. The data obtained are of high quality and constitute a comprehensive data base of static ground

tests at various flap and engine settings and flight tests at typical STOL takeoff, taxi, cruise, and landing. GRA

N81-26848# Materials Research Labs., Ascot Vale (Australia).
APPROACHES TO A QUANTITATIVE ANALYTICAL DESCRIPTION OF LOW FREQUENCY SOUND ABSORPTION IN SEA WATER
Daniel J. Whelan Sep. 1980 48 p refs
(AD-A099295; MRL-R-791; AR-002-371) Avail: NTIS HC A03/MF A01 CSCL 20/1

The absorption of sound in sea water at low frequency (1-100 kHz) and intermediate frequency (50-500 kHz) ranges can be defined by a series of relaxation phenomena, each of which can be described mathematically by a Debye relationship. Below 5 kHz, the principal absorption mechanism is attributed to borate and magnesium/carbonate interactions, while in the range 5 to 50 kHz the absorption arises from magnesium sulphate ion pair formation in sea water. The dependence of the various relaxation modes on oceanographic variables is outlined in quantitative terms based on results from deep ocean sound channel experiments and laboratory experiments. GRA

N81-26849*# Boeing Commercial Airplane Co., Seattle, Wash.
YC-14 INTERIOR NOISE MEASUREMENTS PROGRAM Technical Report, Oct. 1975 - Oct. 1977
L. M. Butzel Mar. 1981 149 p refs Sponsored in part by NASA
(Contract F33657-72-C-0829; AF Proj. 2401; AF Proj. 1471; AF Proj. 1367)
(NASA-CR-164523; AD-A098799; D748-10113-4; AFFDL-TR-77-128) Avail: NTIS HC A07/MF A01 CSCL 20A

A test and preliminary analysis program was conducted to develop a data base and initial understanding of the interior noise of a Upper Surface Blowing STOL airplane using the YC-14 as a test vehicle. A data base has been secured consisting of concurrent cabin noise; exterior fuselage fluctuating pressures; fuselage wall vibrations; and associated aerodynamic, propulsive, and mechanical performance values covering the normal operating envelope of the airplane. Results from preliminary analysis of data show orderly and intuitively reasonable trends. The resultant data base is judged capable of supporting further detailed analysis. GRA

N81-26850# Science Applications, Inc., McLean, Va.
EFFECTS OF THE GULF STREAM ON ACOUSTIC PROPAGATION Final Report
Angela DAmico Jul. 1980 154 p refs
(Contract N00014-79-C-0481)
(AD-A099406; SAI-81-221-WA) Avail: NTIS HC A08/MF A01 CSCL 20/1

This report investigates the effect of the Gulf Stream frontal system on acoustic propagation relative to tactical sonar systems (.1-20 HKZ). An oceanographic description of the Gulf Stream frontal system is included. Two ray models (MPP and GRASS) and one wave model (PE) were compared against measured acoustic data. The appendix contains ray plots and transmission loss estimated for many source/receiver geometries across the Gulf Stream. Author (GRA)

N81-26851# Rockwell International Science Center, Thousand Oaks, Calif. Science Center.
ACOUSTIC EMISSION SIGNATURE ANALYSIS Technical Progress Report, Mar. 1979 - 20 Feb. 1980
Otto Buck and J. W. Pardee Mar. 1981 36 p refs
(Contract ER-78-C-03-2029)
(DOE/ER-02029/T1) Avail: NTIS HC A03/MF A01

Acoustic emission (AE) in plate glass and steel was studied as a function of angle. The low frequency AE in glass was studied in detail, and contributions from P, S, and Rayleigh waves identified. These results were isotropic, as expected theoretically. Limited high frequency (5 to 20 MHz) results were obtained in glass. The measurement of AE on transgranular crack growth in steel during fatigue crack growth was accomplished by use of a low noise manual hydraulic loading system and an electronic gate to reject grip noise. The concept of the wave momentum of an AE was elaboratored and a measurement technique suggested. The theoretical study of this problem led to the discovery of an infinite family of elastic surface (Rayleigh-like) waves, and to further cylindrical, radially propagating plate waves. DOE

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-26852 Oregon Univ., Eugene.
ANGULAR DISTRIBUTION TESTS FOR LEPTON PAIR PRODUCTION Ph.D. Thesis
John Peter Ralston 1980 190 p
Avail: Univ. Microfilms Order No. 8109693

The experimental production of high invariant mass lepton pairs, or dimuons, from colliding hadrons is discussed. By investigating the angular and transverse momentum distribution of the lepton pair with polarized and unpolarized hadrons, tests are derived for parton models that do not depend on arbitrary input. In addition, the compatibility of the Drell-Yan model with axial gauge Quantum Chromodynamics (QCD) is discussed. The problem of collinear singularities in QCD perturbation theory calculations of non-leading terms such as the angular distribution coefficients is reviewed. The leading effect on the dimuon transverse momentum distribution arising from the first corrections to the quark annihilation Green Function in axial gauge QCD is calculated. Dissert. Abstr.

N81-26853 Yale Univ., New Haven, Conn.
TOPICS IN CLASSICAL KINETIC TRANSPORT THEORY WITH APPLICATIONS TO THE SPUTTERING AND SPUTTER-INDUCED MASS FRACTIONATION OF SOLID SURFACES AND PLANETARY ATMOSPHERES Ph.D. Thesis
Charles Coffey Watson 1980 240 p
Avail: Univ. Microfilms Order No. 8110548

The effect of the spatial correlations of particles at high densities on the collisional transfer of momentum in a hard sphere gas is considered. The mutual shielding of nearest neighbors is found to enhance head-on encounters, producing a collisional chaining effect. The problem of nonstoichimetric sputter-erosion in multicomponent media is addressed. The domination of the emerging flux by those atoms which couple more efficiently, in terms of collisional energy transfer, to the bulk of the medium is proposed. The erosion of gravitationally bound gas by sputtering is considered. In this context, the exobase of an energetic ion flux, e.g., the solar wind is discussed. Cascade-type sputtering in the exobase region and the direct ejection of primary recoils from theupper exposphere are considered. Preferential sputtering of planetary atmospheres is considered. Dissert. Abstr.

N81-26854 Brown Univ., Providence, R. I.
THE POLAR TENSORS IN MOLECULAR SYSTEMS CONTAINING ANOMALOUS EFFECTIVE ATOMIC CHARGES Ph.D. Thesis
Kwan Kim 1980 198 p
Avail: Univ. Microfilms Order No. 8111123

The integrated band intensities of the fundamental vibrational modes of hydrogen cyanide, acetylene, fluoroform, sulfur hexafluoride, and cyanogen were measured by the Wilson-Wells-Penner-Weber method. These data were analyzed to determine the atomic polar tensors, fluorine atoms in HC, HCCH, HCN, HCCH, CHF3 and SF6. The theoretical calculations show that the contributions of the charge flux term of the classical atomic charge model of a molecule and a quantum mechanical interference term are as important as the classical net atomic charge, in characterizing the atomic polar tensors. The effective atomic charge seems not to be affected greatly by the basis set compared to the case of atomic polar tensor. Dissert. Abstr.

N81-26855 Boston Univ., Mass.
STRUCTURE IN THE THRESHOLD EXCITATION FUNCTIONS OF HIGH RYDBERG STATES OF HELIUM PRODUCED BY ELECTRON IMPACT Ph.D. Thesis
Robert Bruce Lyons 1981 226 p
Avail: Univ. Microfilms Order No. 8112214

Excitation functions of high Rydberg HR states of helium in electron-atom collisions are measured. The bombarding electron beam passes through an electron monochromator prior to colliding with an atomic beam of helium crossing the electron beam at right angles. A fraction of the HR atoms produced in electron atom collisions are through a state-selecting electric field, and are then field-ionized in a second electric field. Selected sets of HR states are detected. Under certain conditions HR excitation functions exhibit oscillatory structure just above the ionization threshold. A theoretical model interference between the amplitudes for two competing HR state excitation mechanisms is developed. The impact energy dependence of the model is contained in a sudden approximation computation of the amplitude for the transition from the intermediate state to the final state in the indirect mechanism. A calculation based on the interference of the two excitation amplitudes accounts for the observed structure. Dissert. Abstr.

N81-26856 Wisconsin Univ. - Madison.
***A SEMICLASSICAL APPROACH TO THE SCATTERING OF DIATOMIC MOLECULE BY ATOMS* Ph.D. Thesis**
Kenneth Alan Cox 1980 151 p
Avail: Univ. Microfilms Order No. 8106492

The S matrix for the collision of an atom and a diatomic molecule may be defined in terms of the solution of a set of coupled differential equations for the wavefunctions or, alternatively, an equivalent set of equations for a set of amplitude functions. A set of functions which diagonalize the coupling matrix is introduced and used to transform the amplitude functions to a representation in which they are in direct correspondence with individual classical trajectories. In this representation the amplitude functions are the solutions of an integro-differential equation. For the special case in which the interaction between the atom and the molecule is impulsive, an equation for the S matrix can be obtained simply by applying the boundary condition on the wavefunction at the point of impact. From the classical limit solution to this equation the semiclassical S matrix is obtained for the collinear collision of an atom and a harmonic oscillator as well as for three dimensional collisions of rigid spheres and rigid ovaloids. Dissert. Abstr.

N81-26857 California Univ., Los Angeles.
SMALL ANGLE PROTON-PROTON AND PROTON-DEUTERON ELASTIC SCATTERING AT 800 MeV Ph.D. Thesis
Farokh Irom 1980 169 p
Avail: Univ. Microfilms Order No. 8111234

The differential cross section for elastic proton-proton scattering at laboratory angles ranging between 1.34 and 6.45 deg, the analyzing power for elastic proton-proton scattering at laboratory angles ranging between 2.8 and 6.45 deg, and the differential cross sections and analyzing powers for elastic proton-deuteron scattering at laboratory angles ranging between 3.97 and 13.1 deg at 800 MeV incident proton energy were obtained by measuring the energy of recoil particles. The data were analyzed to to obtain information about the hadronic parts of the proton-proton and proton-neutron forward scattering amplitudes. The values for the real and imaginary parts of the scattering amplitudes divided by sin theta are compared with the results of recent phase shift analyses and forward dispersion relation calculations. Dissert. Abstr.

N81-26858 Pittsburg Univ., Pa.
***CHARGED PION PHOTOPRODUCTION FROM LIGHT NUCLEI* Ph.D. Thesis**
Manohar Kularatnam Singham 1980 165 p
Avail: Univ. Microfilms Order No. 8112636

The photoproduction of 0-150 MeV charged pions from nuclei is calculated using a distorted wave impulse approximation (DWLA) approach. In each case, the final nuclear states are restricted to a finite set of isospin analogs of excited statesof the target nucleus. The final state interactions of the pion with the residual nucleus are incorporated via optical potentials. The elementary photoproduction operator used is that of Blomqvist and Laget whichis derived in a general reference frame. Agreement is obtained between theory and experiment as long as the nuclear wave functions are constrained to fit other electromagnetic and weak processes and thee optical potentials are constrained to fit pion-nucleus elastic scattering data. Using the Blomqvist-Laget operator in a DWLA calculation adequately describes the dynamics of charged pion photoproduction from complex nuclei. This reaction can be used to obtain information on the short range nature of the pion wave function and on nulcear wave functions. Dissert. Abstr.

N81-26859 California Inst. of Tech., Pasadena.
***ATOMIC STRUCTURE OF TRANSITIONAL METAL-BASED METALLIC GLASSES* Ph.D. Thesis**
Arthur Ray Williams 1981 104 p
Avail: Univ. Microfilms Order No. 8111498

The atomic scale structure of several transition metal based metallic glasses is investigated by X-ray diffraction techniques. Current dense random packing models are found to have only a superficial resemblance to the structure of real amorphous metallic alloys, and a theoretical density for amorphous transition metals is obtained which might be used as a filter for more realistic single component models in the future. The partial pair distribution functions for individual pairs of atomic species are obtained for glassy alloys of lanthanum with aluminum, gallium, and gold through the use of isomorphous alloys. These systems are demonstrated to be chemically ordered and the short range order of these alloys is shown to be quite different from that of typical amorphous transition metal metalloid alloys. Dissert. Abstr.

N81-26860# Naval Research Lab., Washington, D. C.
NUMERICAL STUDY OF SPACE CHARGE LIMITED TRANSPORT IN A QUADRUPOLE TRANSPORT SYSTEM WITH 90 DEG PHASE ADVANCE
Irving Haber 21 May 1981 48 p refs
(AD-A098994; NRL-MR-4474) Avail: NTIS HC A03/MF A01 CSCL 20/7

Several computer simulations are described which examine the influence of space charge instabilities on an intense beam propagating down an alternate gradient focused channel. By following the detailed non-linear evolution of this system at various currents it is shown that instabilities can cause emittance growth which, by diluting the phase space density of the beam, can limit the current intensity which can be transported.
Author (GRA)

N81-26861# Vanderbilt Univ., Nashville, Tenn.
DEVELOPMENT PRACTICAL APPLICATION OF THE THEORY OF MATERIALS Final Report, 1 Sep. 1976 - 28 Feb. 1981
John R. vanWazer Apr. 1981 68 p refs
(Grant AF-AFOSR-3145-77; AF Proj. 2303)
(AD-A099163; AFOSR-81-0453TR) Avail: NTIS HC A04/MF A01 CSCL 20/10

This report summarizes research under this Grant to develop new theoretical and computational methods for studying the properties of materials. In particular, it describes the use of ab initio methods to predict (a) chemical bonding in systems composed of heavy elements, (b) relativistic effects in molecules, and (c) relativistic calculation of core-electron (X-ray) ionization spectra and related effects. Author (GRA)

N81-26862# Connecticut Univ., Storrs. Dept. of Physics.
LOW ENERGY INELASTIC ATOMIC AND MOLECULAR COLLISIONS Final Report, 11 Jun. 1979 - 15 Jan. 1981
Edward Pollack and Winthrop W. Smith 15 Apr. 1981 37 p refs
(Contract DAAG29-79-C-0125)
(AD-A098805; ARO-16515.5-P) Avail: NTIS HC A03/MF A01 CSCL 07/4

Ar(++) + Ar collisions are studied with particular emphasis on the single electron capture channels. The dominant process is found to result in Ar(+)(2P) + Ar(+)(3s23p4nl). A weaker process, attributed to the presence of a highly excited Ar(++) state is also seen in the angular range investigated. Our Work on D(+) + H2 showed that rotational excitation of the H2 electronic ground state is the important quasi-elastic process in the E theta 2-1.5 keV deg sq region investigated. Electronic excitation of H2 is seen to occur over a small E theta range. In addition ion-molecule work resulted in a model which could explain previous He(+) + H2 charge-exchange results. Reliable grazing-incidence soft X-ray spectra were taken for the first time showing

multiplet and charge-state structure in the 60-100A range from collisions of intense 80-150 keV P(+) and S(+) ion beams with an Ar gas target. GRA

N81-26863# SRI International Corp., Menlo Park, Calif.
MECHANISMS OF MULTIPHOTON DISSOCIATION OF MOLECULAR IONS Final Report, Sep. 1976 - Mar. 1981
Michael J. Coggiola, James R. Peterson, Philip C. Cosby, and Ronald V. Hodges 30 Apr. 1981 67 p refs
(Contract N00014-76-C-1035; SRI Proj. PYU-5808)
(AD-A099121; SRI-MP-81-82) Avail: NTIS HC A04/MF A01 CSCL 07/5

The dissociation of highly vibrationally excited molecular ions resulting from single infrared photon absorption has been studied. The wavelength dependence of the absorption/dissociation process has been measured, and the photofragments identified. Measurements were also made of the dissociative lifetime following absorption and the photofragment kinetic energy distributions. These measurements show that a strong correlation exists between this single photon dissociation process and the final step of multiphoton dissociation. Based on these results, the dissociation dynamics appear to follow a single statistical mechanism. Author (GRA)

N81-26864# Michigan State Univ., East Lansing.
NUCLEON-NUCLEON THEORY AND PHENOMENOLOGY. MATERIAL FOR A DEPARTMENT OF ENERGY NUCLEAR PHYSICS PROGRAM REVIEW
Peter Signell Mar. 1981 18 p refs
(Contract DE-AC02-79ER-10516)
(DOE/ER-10516/8) Avail: NTIS HC A02/MF A01

The intermediate range nucleon-nucleon interaction is derived using a method that utilizes much shorter and simpler analytic continuation through the unphysical region that lies between the (LC omega)N and (LC omega) (LC omega) physical regions of the N anti N (female) (LC omega) (LC omega) amplitude (with significantly improved accuracy for the nucleon-nucleon interaction). A short range phenomenological potential was constructed that gives a precise fit to the nucleon-nucleon data and is parameterized for easy use in nucleon calculations. Phase shift of the world data below 400 MeV is analyzed especially the large amount of very precise data below 20 MeV and the new data near 55 MeV that have never been analyzed properly. A K-matrix formulation of the Optimal Polynomial Expansion was introduced in order to accelerate convergence of the partial wave series at LAMPF energies. A cooperatively evaluated permanent nucleon-nucleon data bank in the 0-1200 MeV range was set up that can be used by all nucleon-nucleon researchers. DOE

N81-26865# Texas Univ., Austin.
NUCLEAR STRUCTURE STUDIES USING THE HIGH RESOLUTION SPECTROMETER AT THE LOS ALAMOS CLINTON P. ANDERSON MESON PHYSICS FACILITY Progress Report
Jan. 1981 92 p refs
(Contract DE-AS05-80ER-10638)
(DOE/ER-10638/T1) Avail: NTIS HC A05/MF A01

The acquisition of detailed microscopic nuclear structure information (both ground state and excited state) through analysis of experimental data obtained using the High Resolution Spectrometer is discussed. Three types of experiments and related theoretical work are addressed: (1) those which provide nucleon-nucleon data to determine the key amplitudes required for microscopic analysis of intermediate energy p-nucleus elastic and inelastic scattering data; (2) those which provide data that validate fundamental ideas implicit in the formulation of the microscopic theories; and (3) those which provide data to be analyzed to provide detailed nuclear structure information. DOE

N81-26866# Battelle Pacific Northwest Labs., Richland, Wash.
DYNAMIC SCREENING BY PROJECTILE ELECTRONS IN HEAVY COLLISIONS
L. H. Toburen, P. Ziem, N. Stolterfoht, D. Schneider, and M. Prost Sep. 1980 16 p refs Prepared jointly with Hahn-Meitner-Inst. fure Kernforschung, Berlin
(Contract DE-AC06-76RL-01830)
(PNL-SA-8904; CONF-801111-40) Avail: NTIS HC A02/MF A01

Analysis of recent helium and oxygen ion data has shown that the degree of screening of the ion charge can be represented approximately by a model based on the spatial distribution of bound electrons. This screening model is introduced into the binary encounter approximation to account for screening for projectile electrons, and calculated single and double differential cross sections are compared for He(+), He(2+) ionization of argon, and O(5+) ionization of oxygen. Cross sections for ionization including contributions from both target and projectile are calculated. DOE

N81-26867# Los Alamos Scientific Lab., N. Mex.
FORWARD ANGLE QUASI-FREE PROTON-NEUTRON ANALYZING POWERS AT 0.8 GeV
M. L. Barlett Jan. 1981 146 p refs
(Contract W-7405-eng-36)
(LA-8659-T) Avail: NTIS HC A07/MF A01

As the first step in determining the nucleon-nucleon scattering amplitudes at small momentum transfers at 0.8 GeV, quasi-free p vector + n and p vector + p analyzing powers were obtained at laboratory scattering angles from 6 deg to 32.9 deg by scattering 800-MeV polarized protons from a liquid deuterium target. The results of phase-shift analyses are presented in order to study the effects of the quasi-free analyzing power measurements on the determination of the pn scattering amplitudes. Amplitudes obtained from the phase shift analysis are then used in KMT calculations. The results indicate that further nucleon-nucleon measurements are necessary in order to determine the nucleon-nucleon amplitudes unambiguously at 800 MeV. DOE

N81-26868# Argonne National Lab., Ill. High Energy Physics Div.
ISSUES IN MASSIVE LEPTON PAIR PRODUCTION IN HADRONIC INTERACTIONS, 1980
Edmond L. Berger 1980 44 p refs Presented at the 15th Recontre de Moriond, Les Arcs, France, 9 Mar. 1980
(Contract W-31-109-eng-38)
(ANL/HEP/CP-80/24; CONF-800374-11) Avail: NTIS HC A03/MF A01

A discussion is presented of issues of current importance in the theory and phenomenology of massive lepton pair production in hadronic interactions. The relevance of higher twist inverse power terms for all constituent scattering processes is emphasized. DOE

N81-26869# Argonne National Lab., Ill.
MAGNETIC MOMENTS OF COMPOSITE QUARKS AND LEPTONS: FURTHER DIFFICULTIES
Harry J. Lipkin (Weizmann Inst. of Science, Rehovot, Israel) May 1980 9 p refs Presented at the 20th Intern. Conf. on High Energy Phys., Madison, Wis., 17-23 Jul. 1980 Prepared in cooperation with Fermi National Accelerator Lab., Batavia, Ill.
(Contract W-31-109-eng-38)
(ANL/HEP/PR-80/48; CONF-800724-64) Avail: NTIS HC A02/MF A01

The difficulty of obtaining Dirac magnetic moments in composite models with two basic building blocks having different charges is combined with the observation that a light bound fermion state built from heavy constituents must have the Dirac moment in a renormalizable theory. The new constraint on any model that builds leptons from two fundamental fields bound by nonelectromagnetic forces is that the ratio of the magnetic moment to the total charge of the bound state is independent of the values of the charges of the constituents; e.g., such a bound state of a spin 1/2 fermion and a scalar boson will have the same magnetic moment if the fermion is neutral and the boson has charge -e or vice versa. DOE

N81-26870# Argonne National Lab., Ill. High Energy Physics Div.
DIFFRACTIVE PHOTOPRODUCTION OF STRANGENESS AND CHARM: OVERLAP OF QCD AND REGGE MODELS
D. P. Roy 1980 20 p refs Presented at the 20th Intern. Conf. on High Energy Phys., Madison, Wis., 17-23 Jul. 1980
(Contract W-31-109-eng-38)
(ANL/HEP/PR-80/49; CONF-800724-63) Avail: NTIS HC A02/MF A01

An overlap between the perturbative QCD and Regge models for the diffractive photoproduction of strangeness and possibly charm is suggested and supported by explicit comparison between the model predictions. Some of the QCD model parameters are estimated--most notably the gluon x distribution over the region < 0 or = X < or = 0.1. DOE

N81-26871# Battelle Pacific Northwest Labs., Richland, Wash.
DELTA-RAY PRODUCTION IN ION-ATOM COLLISIONS
W. E. Wilson and L. H. Toburen Jul. 1980 17 p refs Presented at the 7th Symp. on Microdosimetry, Oxford, 8 Sep. 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8290; CONF-800944-6) Avail: NTIS HC A02/MF A01

The present state of available data on the production of delta-ray by fast positive ions in collision with targets of biological interest is reviewed. The systematics in the cross sections for proton ionization of molecular targets are discussed, indicating what scaling is possible and summarizing what can be concluded regarding the dependence of the mean delta-ray energies on the chemical makeup of the medium. A comparison of typical data is made with the binary-encounter approximation to illustrate the limitations of this theoretical treatment of the ionization process. DOE

N81-26872# McElroy (Ralph) Co., Austin, Tex.
TOTAL GAMMA RAY PRODUCTION CROSS SECTIONS IN THE INTERACTION OF 1-10 MeV NEUTRONS WITH TUNGSTEN NUCLEI
M. V. Savin, Yu. A. Khoklov, I. N. Paramonova, V. A. Chirkin, V. N. Lunin, and N. N. Zaliavov Jan. 1981 8 p refs Transl. into ENGLISH from Nietronnai Fiz. (Kiev), v. 2 p 103-106 Presented at 1977 All-Union Conf., Kiev Sponsored by DOE Prepared for Los Alamos Scientific Lab.
(LA-tr-81-1) Avail: NTIS HC A02/MF A01

The measurement results for total gamma-ray production cross sections for the energy E sub gamma = 1 to 5 MeV for the (n,x gamma) reactions in natural tungsten are described. The measurements were carried out by means of a linear accelerator source and the time-of-flight technique with a time resolution of 1 ns/m. DOE

N81-26873# California Univ., Berkeley. Lawrence Berkeley Lab. Nuclear Science Div.
ULTRARELATIVISTIC HEAVY IONS
Howel G. Pugh Dec. 1980 19 p refs Presented at the 14th LAMPF Users Group Meeting, Los Alamos, N. Mex., 27-28 Oct. 1980
(Contract W-7405-eng-48)
(LBL-12053; CONF-801061-1) Avail: NTIS HC A02/MF A01

An overview of the historical and current research objectives concerning ultrarelativistic heavy ions is given. The leading theoretical concerns are the behavior of matter at very high-energy density and flux, the general behavior of space time in collisions, relativistic nuclear theory, and quantum chromodynamics. DOE

N81-26874# Brookhaven National Lab., Upton, N. Y.
CP VIOLATION AND THE DEVELOPMENT OF COSMOLOGICAL BARYON ASYMMETRY
Goran Senjanovic 1980 32 p refs Presented at the Workshop on Weak Interactions as Probes of Unification, Blacksburg, Va., 3 Dec. 1980
(Contract DE-AC02-76CH-00016)
(BNL-29025; CONF-801244-3) Avail: NTIS HC A03/MF A01

A discussion of the origin of the observed matter-antimatter asymmetry of the universe is presented in the contex of the standard cosmological model. Except in the case of the minimal SU(5) theory, it is possible that grand unified theories predict the right order of magnitude for the ratio of baryon to photon number. The question of CP violation is addressed in detail and it is shown that, tied up with symmetry nonrestoration at high temperature, the soft CP violation does remain T approximately 10 to the 15th power GeV, leading to the creation of baryon asymmetry in the very early universe. DOE

N81-26875# Argonne National Lab., Ill. High Energy Physics Div.
INELASTIC THRESHOLDS AND DIBARYON RESONANCES
Bonnie J. Edwards and Gerald H. Thomas Jun. 1980 45 p refs Presented at the 20th Intern. Conf. on High Energy Phys., Madison, Wis., 17-23 Jul. 1980 Submitted for publication Sponsored in part by the Natural Sciences and Engineering Research Council of Canada
(Contract W-31-109-eng-38)
(ANL/HEP/PR-80/30; CONF-800724-71) Avail: NTIS HC A03/MF A01

A method of Basdevant and Berger is applied to the problem of whether there are pp resonances near the n delta (+ +) threshold. In particular, the (1)D(2) partial wave of proton-proton elastic scattering is analyzed around this threshold. The method is expected to determine (in principle) whether the pp partial waves in which structure has been observed are resonant and, in this event, allow a reliable determination of the resonance parameters. DOE

N81-26876# Carnegie-Mellon Univ., Pittsburgh, Pa.
MESON-NUCLEAR INTERACTIONS AT MEDIUM ENERGIES
R. A. Eisenstein 1981 22 p refs Presented at the Workshop on Nucl. and Particle Phys. at Energies up to 31 GeV, Los Alamos, N. Mex., 5-8 Jan. 1981
(Contract DE-AS02-76ER-03244)
(COO-3244-80; CONF-810115-6) Avail: NTIS HC A02/MF A01

A brief review of selected directions in medium energy physics is given. Special attention is paid to the propagation of hadrons in the nuclear medium which results in a modification of the free properties of the probe hadron and the nucleus. Examples are given involving pion and kaon scattering, absorption, and production from nuclei. DOE

N81-26877# Argonne National Lab., Ill.
EXOTIC BARYONS
A. Yokosawa 1980 19 p refs Presented at the Baryon 80 Conf., Toronto, 14 Jul. 1980
(Contract W-31-109-ENG-38)
(ANL/HEP/CP-80/50; CONF-800763-5) Avail: NTIS HC A02/MF A01

The present status of exotic baryons is discussed. These include the S = 0 and S = + or - 1 system and five-quark exotic levels. DOE

N81-26878# Argonne National Lab., Ill. High Energy Physics Div.
HIGHER TWIST QCD TERMS IN HIGH-P SUB T PION PRODUCTION
E. L. Berger, Thomas Gottschalk, and D. Sivers Aug. 1980 7 p ref Presented at the 20th Intern. Conf. on High Energy Phys., Madison, Wis., 16-23 Jul. 1980
(Contract W-31-109-eng-38)
(ANL/HEP/CP-80/59; CONF-800724-74) Avail: NTIS HC A02/MF A01

The higher twist subprocesses q G going to q pi (+-) and q anti q going to G pi (+-) are investigated in the framework of perturbative quantum chromodynamics (QCD). Cross sections for these processes are compared with the minimum twist QCD results for q anti q going to q anti q and q G going to q G. The higher twist terms give sizeable corrections to the inclusive pion yields, particularly for q anti q initial states. The effects of higher twist QCD terms for the charge ratio, N (Pi(-) N going to pi(-) X)/N (pi(-)N going pi(+) X) are examined. DOE

N81-26879# Argonne National Lab., Ill. High Energy Physics Div.
QCD CORRECTIONS TO NEUTRINO CHARM PRODUCTION
Thomas Gottschalk Aug. 1980 4 p refs Presented at the 20th Intern. Conf. on High Energy Phys., Madison, Wis., 16-23 Jul. 1980
(Contract W-31-109-eng-38)
(ANL/HEP/CP-80/62; CONF-800724-68) Avail: NTIS HC A02/MF A01

Some results of the O alpha (sub s) chromodynamic corrections to neutrino production of heavy quarks are summarized. The basic output of the perturbative calculation itself is the set of kernels relating the charm production structure functions F(sub j) to quark and gluon densities measured in electroproduction. DOE

N81-26880# Argonne National Lab., Ill. High Energy Physics Div.
REVIEW OF N-N SCATTERING
Akihiko Yokosawa 1980 5 p refs Presented at the 20th Intern. Conf. on High Energy Phys., Madison, Wis., 16-23 Jul. 1980
(Contract W-31-109-eng-38)
(ANL/HEP/CP-80/63; CONF-800724-69) Avail: NTIS HC A02/MF A01

Structures appearing in various experimental data (particularly those with polarized beams) in nucleon-nucleon systems are reviewed. A number of candidates are presented for dibaryon resonances which can couple to nucleon-nucleon systems. The present status of experimental data in the nucleon-nucleon system is discussed. DOE

N81-26881# Clark Univ., Worcester, Mass.
ATOMIC MASS MEASUREMENTS AND NUCLEAR SPECTROSCOPY AT TRISTAN Progress Report, 1 Jul. 1980 31 Jan. 1981
Daeg S. Brenner Feb. 1981 14 p refs
(Contract DE-AA02-79CH-10027)
(DOE/ER-10493/3) Avail: NTIS HC A02/MF A01

This research program is concerned with measuring atomic masses and decay schemes of short-lived, neutron-rich fission products with the TRISTAN on-line mass separator located at the High Flux Beam Reactor (HFBR), Brookhaven National Laboratory. The determination of accurate masses for neutron rich nuclei is useful in refining mass equations which, in turn, are important for calculations related to astrophysical processes and to control and to safety of nuclear reactors. During the period covered by this report, efforts were made to aid Brookhaven personnel in the installation and testing of TRISTAN and the associated computer systems, and to begin a program of measurements of beta-ray end-point energies and nuclear decay schemes following successful demonstration of the facility. DOE

N81-26882# Massachusetts Inst. of Tech., Cambridge. Center for Theoretical Physics.
HADRON NUCLEAR INTERACTIONS
H. Feshbach Oct. 1980 108 p refs Presented at the Intern. School of Phys. Enrico Fermi, Lake Como, Italy, Jul. 1980
(Contract DE-AC02-76ER-03069)
(CONF-800787-1) Avail: NTIS HC A06/MF A01

The elastic and inelastic scattering of intermediate energy protons by nuclei is considered. The determination of the proton-nucleus optical potential is discussed in terms of the elementary nucleon-nucleon scattering amplitudes and the properties of the target and residual nucleus. Then the interaction of pions with nuclei for energies in the neighborhood of the delta resonance is discussed. In this energy domain an incident pion will with high probability be absorbed by a nucleon to produce the delta resonance and thus form delta particle hole state in the nucleus. Next, the subject of hypernuclei is taken up. Experiments involving the collision of ultrarelativistic hardrons, protons, pions, kaons (up to Fermilab energies) with nuclei are described. DOE

N81-26883# Brookhaven National Lab., Upton, N. Y.
INELASTIC NEUTRON SCATTERING STUDIES OF SINGLE-CRYSTAL TmSe
B. H. Grier and S. M. Shapiro 1981 4 p refs Presented at Conf. on Valence Fluctuations in Solids, Santa Barbara, Calif., 27 Jan. 1981
(Contract DE-AC02-76CH-00016)
(BNL-28989; CONF-810129-1) Avail: NTIS HC A02/MF A01

The energy of the 10 MeV line exhibits weak dispersion across the Brillouin zone, while the intensity and linewidth show a stronger q vector dependence. The excitation is broader and less intense near the zone center than at the zone boundary. This feature results from the excitation of f-electrons across the hybridization gap formed when the localized f-electrons hybridize with the conduction band. The temperature and q vector dependences are consistent with a recent theoretical calculation of the neutron cross section for this case. DOE

N81-26884# Mound Lab., Miamisburg, Ohio.
ASSESSMENT OF THE RADIOLOGICAL IMPACT OF COAL UTILIZATION. 2: RADIONUCLIDES IN WESTERN COAL ASH
Clarence E. Styron, Carl T. Bishop, Vito R. Casella, Phillip H. Jenkins, and William H. Yanko 3 Apr. 1981 177 p refs
(Contract DE-AC04-76DP-00053)
(MLM-2810) Avail: NTIS HC A09/MF A01

The potential radiological impact of coal utilization is investigated. A survey of western US coal mines and an assessment of emissions from a power plant burning Western coal were performed. Environmental deposition of radionuclides from stack emissions over a 20 year accumulation at a power plant burning Western coal was estimated to be 0.1 to 1.0% of measured background. An interlaboratory comparison of resluts of radioanalytical procedures, determining partitioning coefficients for radionuclides in bottom ash and fly ash, and an assessment of the potential for migration of radionuclides from ash disposal sites are made. Essentially all the nonvolatile radionuclides (uranium, radium, and thorium) from feed coal are accounted for in fly ash and bottom ash. However, 20 to 50% of the volatile radionuclides (lead and polonium) from subbituminous and lignitic coals are not accounted for in ahs, and it is assumed that this fraction exists via the stack. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N81-26885 Brown Univ., Providence, R. I.
A NEW SEMICLASSICAL APPROACH IN CHARGED SCALAR QED Ph.D. Thesis
James Paul Kowall 1980 173 p
Avail: Univ. Microfilms Order No. 8111127

Field degrees of freedom are replaced with particle coordinates through the introduction of Feynman path integrals. The canonical formalism for charged scalar QED, with all Green's functions written in terms of functional integrals, is converted into a loopwise expansion of the theory, obtained via the path integral formulation. The connection of Schwinger-Dyson equations and Ward-Takahashi identities to the particle coordinate equations of motion is explored. The one charged-scalar closedloop contribution to the photon propagator in two dimensional scalar QED is calculated using the path integral formulation. The semiclassical approximation developed gives the asymptotic behavior of the large order terms in the perturbation series expansion of the one loop contribution to the photon self energy. This is performed via the expansion in collective coordinates about classical particle trajectories that dominate the large order behavior. The expansion in collective coordinates is worked out exactly for the calculation of this Green's function. Dissert. Abstr.

N81-26886 Brown Univ., Providence, R. I.
QUANTUM FIELD THEORY OF KOSTERLITZ-THOULESS PHASE TRANSITIONS Ph.D. Thesis
Michael Charles Ogilvie 1980 176 p
Avail: Univ. Microfilms Order No. 8111155

A general quantum field theoretic formalism for the study of Kosterlitz-Thouless phase transition is developed and applied to several models. The structure of the free, massless scalar field is discussed, making explicit its connection with the Gaussian model. The close connection of the spin wave and vortex operators with two dimensional fermion-boson equivalences is stressed. The critical behavior of the planar model is reviewed, using field theoretic methods applied to the sine Gordon model. The Kosterlitz-Thouless phase transition in two dimensional dislocation

mediated melting is studied using a vector generalization of the sine-Gordon model. Recent second order renormalized group calculations are confirmed, and the issue of universal third order corrections is discussed. It is shown that the Gross-Neveu model can be interpreted as a massive theory associated with a Kosterlitz-Thouless critical point. Finally, the Ising and Baxter models are studied using the methods developed. Dissert. Abstr.

N81-26887 Brown Univ., Providence, R. I.
A PRISM PLOT ANALYSIS OF THE REACTION POSITIVE Pi (+) P YIELDS P Pi (+) Pi-0 AT 4.1 GeV/c Ph.D. Thesis
Martin Edward Heller 1980 106 p
Avail: Univ. Microfilms Order No. 8111110

The separated channels were studied and the dominant resonances fit with the dual absorptive model. The delta + + is found to be consistent with that extracted from higher momentum data by conventional means and is well fit by the model using rho exchange. The rho + is well fit by an extended parameterization of the model at all but the lowest momentum transfers. Omega-meson exchange is indicated as the dominant mechanism for the reaction pi + p going to p rho + for momentum transfers greater than 0.02 GeV2/c2; pion exchange is suggested as the probable mechanism at lower momentum transfers.
Dissert. Abstr.

N81-26888# Naval Research Lab., Washington, D. C.
AN INITIAL STUDY OF THE INJECTION OF AN INTENSE RELATIVISTIC ELECTRON BEAM INTO THE ATMOSPHERE
R. B. Fiorito, R. F. Fernsler, J. H. Greig, M. Herndon, and L. M. Vitkovitsky 4 Mar. 1981 49 p refs
(RR0110942)
(AD-A098896; NRL-MR-4405) Avail: NTIS HC A03/MF A01 CSCL 20/8

Using the VEBA pulse generator (approx. or less than 2 MV, approx 60 kAmp, approx. 60 ns) and a field emission diode with a titanium foil anode (approx. 43 micrometers), relativistic electron beams with v/y approx. 0.5 have been produced and injected into the atmosphere. Typical injected net currents were approx. 35 kAmps and there was little plasma return current (approx. or less than 20%). These beams were observed to expand and contract at the betatron wavelength lambda sub beta approx. 12 cm) as they propagated through the atmosphere and to become unstable at approx. lambda sub beta. Observations were made in both visible light (2000-6000 Angstroms and x-radiation (10-100 keV). Peak current densities reached approx. 3kAmp/sq. cm. at approx. 20 cm from the diode where the beam appeared to consist of two separate coaxial components both of near uniform current density. The central component contained approx. 65% of the total beam current and was initially within a radius of approx. 1.4 cm. The outer component of the beam started with a radius of approx. 5 cm (defined by the anode foil) and appeared to expand steadily. The visible emissions belonged to the species N2 and N2+ and were synchronous with the electron beam current. The absolute emission in the band N2+ 1N(0-0) agreed with the calculated fluorescence intensity within experimental uncertainty, but the emission in the band N(2)2P(0-0) was approx 6 times larger than suggested by simple fluorescence calculations. A simple technique was devised to select a fraction of the electron beam emerging from the diode to produce a pinched matched beam. Author (GRA)

N81-26889# TRW Defense and Space Systems Group, Redondo Beach, Calif.
LONG-PULSE KrF AMPLIFIER AS AN ICF DRIVER
R. S. Bradford, Jr., J. A. Betts, and R. Aprahamian 1981 8 p refs Presented at SPIE Symp. on High-Powered Lasers and Applications, North Hollywood, Calif., 11 Feb. 1981
(Contract DE-AC08-78DP-40069)
(DOE/DP-40069/4; CONF-810204-3) Avail: NTIS HC A02/MF A01

Using a master oscillator power amplifier configuration, 100J was obtained from a 5 1 optical volume KrF amplifier pumped at 300 kW/cu cm peak at the end of a 500 nsec pulse. A normalized input flux of 0.4 (I/I sub sat) was required to reduce amplified spontaneous emission to one half the free running value. A peak extraction efficiency of 0.46 was obtained under these conditions at 1 atm total pressure. A kinetics model was developed and refined to give excellent agreement with high and low pump regimes. An integrated kinetics and pulse propagation code was also developed and agrees well with experiment. DOE

N81-26890# California Univ., Berkeley. Lawrence Berkeley Lab.
HEAVY ION INDUCTION LINACS FOR ICF
A. Faltens, E. Hartwig, E. Hoyer, D. Keefe, L. J. Laslett, R. Bangerter, and J. Mark Oct. 1980 6 p refs Presented at the Am. Nuc. Soc. Topical Meeting on Tech. of Controlled Nuc. Fusion, Valley Forge, Pa., 14 Dec. 1980
(Contract W-7405-eng-48)
(LBL-12204; CONF-801248-1) Avail: NTIS HC A02/MF A01

A review of some of the main characteristics of current induction linacs is given. Emphasis is placed on particle acceleration for induction use in inertial fusion confinement. T.M.

N81-26891# Stanford Linear Accelerator Center, Calif. Linear Accelerator Center.
DRIFT AND PROPORTIONAL TRACKING CHAMBERS
John A. Jaros Nov. 1980 22 p refs Presented at the SLAC Summer Inst., Stanford, Calif., 28 Jul. - 8 Aug. 1980
(Contract DE-AC03-76SF-00515)
(SLAC-Pub-2647; CONF-800782-2) Avail: NTIS HC A02/MF A01

The many techniques exploited in constructing tracking chambers, particle detectors which measure the trajectories and momenta of charged particles, are discussed. In high energy interactions, the final states are dominated by closely collimated jets of high multiplicity, requiring good track-pair resolution in the tracking chamber. High energy particles deflect very little in limited magnetic field volumes, necessitating good spatial resolution for accurate momentum measurements. The colliding beam technique requires a device easily adapted to full solid angle coverage, and the high event rates expected in some of these machines put a premium on good time resolution. Finally, the production and subsequent decays of the tau, charmed and beautiful mesons provide multiple vertex topologies. To reconstruct these vertices reliably requires improvements in spatial resolution and track pair resolution. The proportional counter and its descendant, the drift chamber, are considered as tracking chambers. The physics of this device are discussed in order to understand its performance limitations and promises.
Dissert. Abstr.

N81-26892# Argonne National Lab., Ill. High Energy Physics Div.
PHYSICS WITH POLARIZED BEAMS ABOVE GeV REGION
Akihiko Yokosawa 1980 13 p refs Presented at the 15th Rencontre de Moriond, Savoy, France, 9-15 Mar. 1980; sponsored by the Inst. National de Physique Nucleaire et de Physique de Particules and the Commissariat a L'Energie Atomique
(Contract W-31-109-eng-38)
(ANL/HEP/CP-80/14; CONF-800374-12) Avail: NTIS HC A02/MF A01

Polarized beam experiments are overviewed with reference to their contributions to particle theory. A polarized beam line up to 600 GeV/c is also discussed. DOE

N81-26893# California Univ., Berkeley. Lawrence Berkeley Lab.
ION ACCELERATORS AS DRIVERS FOR INERTIAL CONFINEMENT FUSION
A. Faltens, D. Keefe, and S. S. Rosenblum Nov. 1980 6 p refs Presented at 6th Conf. on Appl. of Accelerators in Res. and Industry, Denton, Tex., Nov. 1980
(Contract W-7405-eng-48)
(LBL-12145; CONF-801111-39) Avail: NTIS HC A02/MF A01

During the past few years the possibility of using intense ion beams to ignite a pellet of fusion fuel has looked increasingly promising. Ion beams ranging in mass from protons up to uranium have been investigated and several machines have been built a different laboratories to investigate the required technology. Light ion drivers are based on the use of high current, high current, high voltage diodes arranged around a central target.

These devices have the necessary power and energy to initiate fusion burn but suffer from the inability to transport stably the necessary huge beam currents over long distances to a small target. Heavy ion dirvers are based either on the radio-frequency linac or the induction linac. Because heavy ions have a much shorter range than light ions of the same energy, one is able to raise the beam voltage by a factor of one-thousand and lower the current correspondingly. DOE

N81-26894# Harvard Univ., Cambridge, Mass. Energy and Environmental Policy Center.

ALTERNATIVE INSTITUTIONAL ARRANGEMENTS FOR NUCLEAR POWER

D. Bussard Aug. 1980 8 p refs

(Contract DE-AC01-80PE-70278)

(DOE/PE-70278/T11) Avail: NTIS HC A02/MF A01

An investigation of how alternative organizations of nuclear power generation would effect the regulatory environment for nuclear power production and how it would effect financial constraints on construction is discussed. The existence of governmental barriers to such reorganization are described. DOE

N81-26895# Battelle Pacific Northwest Labs., Richland, Wash.

TWO FACTORS IMPORTANT TO THE CRITICALITY POTENTIAL OF SPENT FUEL IN GEOLOGIC REPOSITORIES

B. F. Gore and U. P. Jenquin Feb. 1981 29 p refs Presented at the Am. Nucl. Soc. Topical Meeting, Tucson, Ariz., 23-26 Feb. 1981

(Contract DE-AC06-76RL-01830)

(PNL-SA-9247; CONF-810217-10) Avail: NTIS HC A03/MF A01

The residual fissile content of the fuel, and the extent to which geochemical processes might somehow separate and accumulate plutonium from other spent fuel materials are investigated. The results of two surveys defining conditions required for criticality are presented. Homogeneous spherical mixtures of spent fuel actinide oxides and water are analyzed with water reflection. Graphs of minimum critical mass vs duration of in-reactor exposure are presented. The effects of initial enrichment, post exposure radioactive decay, and addition of rock materials to the mixture are considered. Homogeneous spherical waterless mixtures containing plutonium and a neutronically optimized rock material, are analyzed with a thick rock neutron reflector. Graphs of Pu critical mass are presented as a function of concentration over the range from 2 to 100 g Pu/1. The effects of rock composition, Pu240 content, and uranium contamination of the plutonium are considered. DOE

N81-26896# Battelle Pacific Northwest Labs., Richland, Wash.

MANAGEMENT OF INTERMEDIATE-LEVEL RADIOACTIVE WASTES IN THE UNITED STATES

R. L. Aaberg, L. T. Lakey, and J. Greenborg (General Public Utilities Service Corp.) Jul. 1980 21 p refs Presented at the 89th Ann. Meeting of the Am. Inst. of Chem. Engr., Portland, Oreg., 17-20 Aug. 1980

(Contract DE-AC06-76RL-01830)

(PNL-SA-8755; CONF-800802-25) Avail: NTIS HC A02/MF A01

The term intermediate-level waste (ILW) is not a clearly defined waste category. Assuming the ILW includes all radioactive wastes requiring shielding but not ordinarily included in a high-level waste canister, its major sources include power plant operations, spent fuel storage, and spent fuel reprocessing. Power plant waste, constituting approximately 87 percent of the waste volume, is generally nontransuranic waste. The other approximately 13 percent from fuel reprocessing is generally transuranic. The wet wastes, primarily power plant resins and sludges, contribute the largest volume; fuel hulls and core hardware represent the greatest activity. Intermediate-level wastes from power plants are disposed of by shallow-land burial. However, the alpha-bearing wastes are being stored pending eventual disposal to a geologic repository or by other means, e.g., intermediate-depth burial, sea disposal. Dissert. Abstr.

N81-26897# Los Alamos Scientific Lab., N. Mex.

BEAM-INTENSITY LIMITATIONS IN LINEAR ACCELERATORS

Robert A. Jameson 1981 6 p refs Presented at the Particle Accelerator Conf., Washington, D.C., 11-13 Mar. 1981

(Contract W-7405-eng-36)

(LA-UR-81-765; CONF-810314-27) Avail: NTIS HC A02/MF A01

The role of physical constraints in channel intensity limitation is emphasized. Work on optimizing channel performance, particularly at low particle velocities, resulted in major technological advances. The opportunities for combining such channels into arrays are discussed. DOE

N81-26898# Oak Ridge National Lab., Tenn.

OAK RIDGE 25-MV TANDEM ACCELERATOR

N. F. Ziegler, E. G. Richardson, J. E. Mann, R. C. Juras, C. M. Jones, J. A. Biggerstaff, and J. A. Benjamin 1981 3 p refs Presented at Particle Accelerator Conf., Washington, D.C., 11 Mar. 1981

(Contract W-7405-eng-26)

(CONF-810314-37) Avail: NTIS HC A02/MF A01

A heavy ion accelerator facility is described and a discussion of some aspects of the first operational experience with the 25 MV tandem accelerator is presented. DOE

N81-26899# Los Alamos Scientific Lab., N. Mex.

RADIO-FREQUENCY QUADRUPOLE: A NEW LINEAR ACCELERATOR

R. H. Stokes, T. P. Wangler, and K. R. Crandall 1981 6 p refs Presented at Particle Accelerator Conf., Washington, D.C., 11 Mar. 1981

(Contract W-7405-eng-36)

(LA-UR-81-768; CONF-810314-33) Avail: NTIS HC A02/MF A01

The radio frequency quadrupole (RFQ) linear accelerator is discussed. In the RFQ, the use of RF electric fields for radial focusing, combined with special programming of the bunching, allows high current dc beams to be captured and accelerated with only small beam loss and low radial emittance growth. Advantages of the RFQ linac include a low injection energy (20 to 50 keV for protons) and a final energy high enough so the beam can be further accelerated with high efficiency in a Wideroee or Alvarez linac. The beam dynamics parameters of three RFQ systems are described. These are the final design for the prototype test of the Fusion Materials Irradiation Test accelerator, the final design for the prototype test of the Pion Generator for Medical Irradiations, and an improved low velocity linac for heavy ion fusion. DOE

N81-26900# Argonne National Lab., Ill.

SUMMARY OF PHYSICS FROM MEASUREMENTS WITH LONGITUDINALLY POLARIZED BEAMS AND TARGETS AT ZGS ENERGIES

A. Yokosawa Sep. 1980 6 p refs Presented at the Intern. Symp. on High Energy Phys. with Polarized Beams and Targets, Lausanne, Switzerland, Sep. 1980

(Contract W-31-109-eng-38)

(ANL/HEP/CP-80/66; CONF-800994-12) Avail: NTIS HC A02/MF A01

An extensive amount of data were obtained from measurements of proton-proton elastic scattering from 1 to 12 GeV/c using longitudinally polarized beams and targets. Physics learned from these data as well as other related experiments results is summarized. The topics include structures observed in nucleon-nucleon scatterin at lower energies and dinucleon resonances, pp scattering amplitude measurements at 6 GeV/c, and large p(sub perpendicular) results in pp elastic scattering. DOE

N81-26901# Los Alamos Scientific Lab., N. Mex.

NONINTERCEPTIVE TRANSVERSE BEAM DIAGNOSTICS

David D. Chamberlin, Gerald N. Minerbo, Lawrence E. Teel, Jr., and John D. Gilpatrick 1981 4 p refs Presented at the Particle Accelerator Conf., Washington, D.C., 11-13 Mar. 1981

(Contract W-7405-eng-36)

(LA-UR-81-769; CONF-810314-25) Avail: NTIS HC A02/MF A01

The transverse emittance properties of a high-current linear accelator may be measured by using TV cameras sensitive to the visible radiation emitted following beam interactions with

residual gas. The TV system being used to measure emittances for the fusion materials irradiation test project is described. DOE

74 OPTICS

Includes light phenomena.

N81-26902 Pennsylvania State Univ., University Park.
CHARACTERIZATION OF LASER ANNEALED SURFACES BY ELLIPSOMETRY Ph.D. Thesis
Sydney Chagweders Mushakarara 1980 84 p
Avail: Univ. Microfilms Order No. 8105776

The potentialities and limitations of ellipsometry as a nondestructive technique were investigated to (1) determine laser annealing energy thresholds and (2) study the laser annealing of the damaged surface layers of semiconductors and optically transparent materials. It was shown that, using a Q switched ruby laser with a pulse width of 20 nanoseconds and pulse energies (energy thresholds) of 1J, it is possible to laser anneal the damages in the surface layers introduced during the preparatory history of single crystal silicon specimens. In the case of vitreous silica and Pyrex it was shown that laser annealing can be achieved using a pulsed CO2 laser with pulse width of 50 milliseconds and energy thresholds of about 21J cm(-2) and 7,8J cm(-2), respectively. Hence, it is shown that polish layers on the surfaces of multicomponent glasses can be laser annealed out. However, for strongly absorbing materials such as single crystal germanium it was shown that special care must be taken to interpret the experimentally determined (delta, psi) values.
Dissert. Abstr.

N81-26903 George Washington Univ., Washington, D.C.
AN INVESTIGATION IN HAMILTONIAN OPTICAL THEORY OF THE PROPAGATION OF COHERENT STATE MODES IN GRADIENT INDEX FIBERS Ph.D. Thesis
Harshad Kantilal Shah 1980 121 p
Avail: Univ. Microfilms Order No. 8106951

An analogy between coherent states and beam modes is elaborated. The operator formalism of quantum mechanics then eliminates need for ad hoc articulation of ray optics with results drawn from physical optics. Off-axis beam modes are generated from the lowest mode of the fiber by a unitary transformation, the parameters of which are the average position and average optical direction cosine. These parameters are (classical) ray coordinates. These off-axis-beam modes are then recognized as eigenfunctions of the operator analogous to annihilation operator (lowering operator intext). Then the (complex) eigenvalues of this operator may be employed as usual to label the beam modes and as the parameter in the representative function. The real and imaginary parts of this complex parameter are proportional to ray coordinates and evolve like classical rays. A Gaussian beam, different from the modes of the fiber, is readily represented in terms of beam modes belonging to the fiber profile, and its evolution is then easily calculated. Dissert. Abstr.

N81-26904 Washington Univ., Seattle.
LOW FREQUENCY RAMAN SCATTERING FROM ENZYME SOLUTIONS Ph.D. Thesis
John Joseph Kester 1980 183 p
Avail: Univ. Microfilms Order No. 8111430

Raman light scattering studies were carried out on aqueous solutions of the enzymes lysozyme and ribonuclease at low frequencies. The dependence of the Raman spectra on protein concentration, solvent effects, inhibitor binding, pH, and temperature were investigated. A conventional Raman spectrometer was modified to provide microprocessor controlled digital detection of scattering from a rotating cell. A least squares fit routine was used to evaluate the contributions of the collision induced vibrational modes of the protein and the solvent. The data is interpreted by a model involving localized modes associated with the hydrogen bonds of the tertiary structure of the enzyme.
Dissert. Abstr.

N81-26905 Brown Univ., Providence, R. I.
RADIATIVE INTERACTION IN A THREE LEVEL SYSTEM Ph.D. Thesis
Tsungming Tsai 1980 158 p
Avail: Univ. Microfilms Order No. 8111186

A concise and rigorous matrix description is given to a homogeneously broadened three level system. On a time scale longer than the optical period, the density matrix equation is reduced to a general laser equation, which is similar to the Bloch equation, by employing a rotating wave transformation followed by a time averaging scheme. An exact solution of the laser equation is obtained from constant exciting field intensities. Optically pumped far infrared laser systems are modeled as three level systems. Using the rate equation formalism, closed form solutions are obtained for the propagation of two laser pulses through a three level medium in the long and short pulse regimes, in the limit of weak FIR field intensity. Analytical expressions for the saturation absorption of the pump field agree well with experimental results. Ultra-short pulse propagation is also investigated in the weak FIR-field limit by directly solving the laser equation. Dissert. Abstr.

N81-26906# Arizona Univ., Tucson. Digital Image Analysis Lab.
OPTICAL COMPUTATIONS FOR IMAGE BANDWIDTH COMPRESSION Final Report, 15 Mar. 1980 - Mar. 1981
B. R. Hunt 15 May 1981 89 p refs
(Grant AF-AFOSR-3024-76; AF Proj. 2305)
(AD-A098823; SIE/DIAL-81-005; AFOSR-81-0449TR)
Avail: NTIS HC A05/MF A01 CSCL 05/8

This report summarizes current research in the investigation of optical computations for image bandwidth compression. The following topics are discussed: a new adaptive image data compression scheme; simulations of an interframe adaptive image data compression scheme; and simulations of an incoherent optical/video feedback processor. Author (GRA)

N81-26907# Hughes Research Labs., Malibu, Calif.
CHARACTERIZATION AND ANALYSIS OF INDIUM DOPED SILICON EXTRINSIC DETECTOR MATERIAL Final Report, 31 Mar. 1977 - 30 Sep. 1979
James Baukus and T. McGill (California Inst. of Technology, Pasadena) Jun. 1980 137 p refs Prepared in cooperation with Calif. Univ., Davis
(Contract DAAK70-77-C-0082; ARPA Order 3211)
(AD-A095982) Avail: NTIS HC A07/MF A01 CSCL 07/5

This final report of a two year program describes progress made in analyzing Si In detector material Hall effect, photoluminescence and IR measurements were performed to charaterize the X level and to determine its nature. GRA

N81-26908# Hughes Research Labs., Malibu, Calif.
BLUE/GREEN COUPLED WAVE FILTER DEMONSTRATION Final Report, 4 Jun. 1980 - 28 Feb. 1981
J. F. Lotspeich and D. M. Henderson May 1981 55 p refs
(Contract N00014-80-C-0606)
(AD-A099159) Avail: NTIS HC A04/MF A01 CSCL 17/2

The performance of AgGaS2 iso-index coupled-wave electro-optic filters in wide-field of view (FOV) operation has been characterized in detail, both theoretically and experimentally. The principal conclusions of this program are: (1) the effect of optical activity on the filter passband is negligible for input light cones smaller than approx. f/10 (3 deg half-angle); (2) for larger FOVs, the main lobe of the filter transfer characteristic broadens considerably, and increased out-of-band transmission occurs; (3) at very large FOVs (aprox. f/0.5), the peak transmittance approaches 50%, virtually independent of applied electric field; (4) the effects of optical activity override attempts to narrow the passband by increasing filter length, resulting in an optimum crystal length of about 3 mm and a minimum passband of about 2 A for f/1 FOV and (1 A for f/2 FOV); (5) significant reduction in out-of-band transmission was shown, using a novel dual-element arrangement with intervening crossed polarizer.
Author (GRA)

N81-26909# Battelle Columbus Labs., Ohio.
OPTICAL WAVEGUIDE SCATTERING REDUCTION, 2 Final Report, 2 Jul. 1979 - 2 Aug. 1980
David W. Vahey, Nile F. Hartman, and Rand C. Sherman Wright-Patterson AFB, Ohio AFWAL Dec. 1980 157 p refs
(Contract F33615-79-C-1852; AF Proj. 2001)

(AD-A098815; AFWAL-TR-80-1186) Avail: NTIS HC A08/MF A01 CSCL 20/6

The goal of this program was the reduction of scattering in optical waveguides to levels commensurate with 40 dB dynamic range for an integrated optical spectrum analyzer. Waveguides formed by thermal diffusion of Ti films into LiNbO3 substrates were emphasized. Nine potential sources of scattering in such waveguides were identified and discussed. Diagnostic methods and optical scattering experiments useful for studying the sources of scattering were described and experimental results for non-scattering experiments were presented. An analysis of the effects of Rayleigh, Rayleigh-Gans-Debye, and Mie scattering on spectrum analyzer dynamic range was performed. Formulas for differential scattering cross sections were derived, and parameter values for various sources of scattering were inserted to obtain estimates of spectrum-analyzer performance for each scattering mechanism. Rayleigh-Gans-Debye scattering centers from surface roughness and surface compounds (probably Li-Ti-O compounds) were found to lead to the largest predicted scattering. Experimental in-plane scattered-energy distributions were complicated by the effects of prism-enhanced scattering, which was theoretically investigated. Data were obtained using either end-fire input coupling or by comparing the scattering generated using two different input-output coupling-prism separations. The best performance achieved was consistent with scattering from either surface roughness or surface-compound formation. The performance was consistent with a spectrum-analyzer dynamic range of only 27 dB. GRA

N81-26910# BDM Corp., Monterey, Calif.

ATMOSPHERIC OPTICAL PROPAGATION COMPARISONS DURING MAGAT-80

C. W. Fairall (Naval Postgraduate School) 19 Sep. 1980 154 p refs

(Contract N00014-78-C-0204)

(AD-A098898; BDM/M-010-80) Avail: NTIS HC A08/MF A01 CSCL 20/6

There are three atmospheric processes responsible for the degradation of the transmission of optical images and electro-optical energy: aerosol extinction, molecular absorption, and turbulent distortion (scintillation and beam wander). As a part of the Monterey Aerosol Generation and Transport experiment (MAGAT-80), light transmission characteristics (refractive-index) structure function parameter, C squared sub N, and total extinction coefficient were measured optically on a 13.3 km path across Monterey Bay. C squared sub N and can also be calculated from micrometeorological data (aerosol spectra, turbulence and mean meteorological parameters). This report is a compilation of the preliminary analysis of path-averaged (aircraft) and midpoint (ship) micrometeorological data, including calculations of the relevant optical parameters for comparison with the optical measurements. Author (GRA)

N81-26911# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.

THIN-FILM ACOUSTO-OPTIC AND ELECTROOPTIC DEVICES WITH APPLICATIONS TO INTEGRATED/FIBER OPTIC SIGNAL PROCESSING AND COMMUNICATIONS Final Technical Report, 1 Jan. 1979 - 30 Sep. 1980

Chen S. Tsai Sep. 1980 30 p refs

(Grant AF-AFOSR-3187-77; AF Proj. 2305)

(AD-A098880; AFOSR-81-0432TR; FTR-3) Avail: NTIS HC A03/MF A01 CSCL 20/6

During the third program year emphasis of research was placed six subareas, namely, very high scanning-rate light beam deflection/switching, spectrum analysis of very wideband RF signals, wideband AO Bragg cell using multiple tilted transducer but without electronic phase shifters, wideband AO Bragg cell using a tilted-finger chirp transducer, improvement in fabrication capability, and acoustooptic Bragg deflection in crossed channel optical waveguides. Major progress and achievements for each are described: Very High Scanning-Rate AO Light Beam Deflection and Switching; Spectrum Analysis of Very Wideband RF Signals; Wideband AO Bragg Cell Using Multiple Tilted Transducer But Without Electronic Phase Shifters; Wideband AO Bragg Cell Using a Tilted-Finger Chirp Transducer; Improvement in Fabrication Capability; and Acoustooptic Bragg Deflection in Crossed Channel Optical Waveguides. GRA

N81-26912# Honeywell Systems and Research Center, Minneapolis, Minn.

ADVANCED PATTERN-MATCHING TECHNIQUES FOR AUTONOMOUS ACQUISITION Final Report, 23 Aug. 1979 - 1 Jan. 1981

P. M. Narendra and B. L. Westover Jan. 1981 123 p refs

(Contract DAAK70-79-C-0114)

(AD-A099127; HONEYWELL-81SRC25) Avail: NTIS HC A06/MF A01 CSCL 17/5

The key objective of this effort is the development of pattern-matching algorithms which can impart autonomous acquisition capability to precision-guided munitions such as Copperhead and Hellfire. Autonomous acquisition through pattern matching holds the promise of eliminating laser designation and enhancing fire power by multiple target prioritization. The pattern-matching approach being developed under this program is based on a symbolic pattern-matching framework, which is suited for the autonomous acquisition scenario. It is based on matching a symbolic representation derived from the two images, and it can accommodate the stringent pattern-matchine criteria established by the scenario: enormous differences in the scene perspective, aspect and range between the two sensors, differences in sensor characteristics and illumination, and scene changes such as target motion and obscuration from one view point ot the other. This report contains a description of an efficient branch-and-bound technique for symbolic pattern matching. Also presented are the results of applying a simulation of the algorithm to pairs of FLIR images of military vehicles in cluttered environments as well as pairs of images from different sensors (FLIR and silicon TV). The computational requirements are analyzed toward real-time implementation, and avenues of future work are recommended. GRA

N81-26913# Hughes Research Labs., Malibu, Calif.

CONTROLLED FIBER OPTIC SWITCHING Final Report, 19 Sep. 1979 - 1 Oct. 1980

O. G. Ramer Wright-Patterson AFB, Ohio AFWAL Dec. 1980 91 p refs

(Contract F33615-79-C-1864; AF Proj. 2001)

(AD-A099390; AFWAL-TR-81-1002) Avail: NTIS HC A05/MF A01 CSCL 20/6

This program has resulted in the demonstration of a low-loss, low-voltage, high-speed four-section delta-beta-reversal switchable optical directional coupler which has been permanently coupled to single-mode fiber pigtails. The measured coupling losses between switch and fibers approach the measured optimum and theoretical predictions. In addition, experimental integrated-optic circuit losses, including waveguide bend, waveguide offsets, metal electrodes, and fiber-to-channel coupling, are presented. Coupling measurements from single-mode fiber to straight waveguides show losses less than 1 dB. Integrated-optic circuit losses due to waveguide bends and offsets were calculated and measured; these data are in excellent agreement. Although the overall loss of the delivered device is approaching theoretical limits, there are areas where obvious improvements are required. GRA

N81-26914# California Univ., Livermore. Lawrence Livermore Lab.

EVALUATION OF FIBER-OPTIC CONNECTORS

R. P. Reedy 24 Feb. 1981 15 p refs

(Contract W-7405-eng-48)

(UCRL-53116) Avail: NTIS HC A02/MF A01

Two fiber optic connectors for field use in high efficiency, long distance systems are described and evaluated. The transmission testing arrangement and other considerations are included with the test results. Techniques for optimizing the transmission through these connectors are also described and the results are reported. Many desirable characteristics of connectors for field use are considered and compared to the ITT and Amphenol connectors tested here. DOE

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-26915 New York Univ., N. Y.
STOCHASTIC WAVE-KINETIC THEORY OF RADIATION TRANSPORT IN A TURBULENT PLASMA Ph.D. Thesis
Marvin Stanley Kruger 1980 123 p
Avail: Univ. Microfilms Order No. 8110751

Radiative transfer equations are derived, on the basis of the stochastic wave kinetic method of Besieris and Tappert, for partially polarized electromagnetic radiation propagating in a turbulent scattering plasma which is (statistically) weakly inhomogeneous, weakly nonstationary, and locally isotropic. Employing the concept of a general wave analytic signal together with the first order smoothing approximation and the formalism of Weyl transform theory a rigorous formulation based on the analysis of a general wave optical tranport equation governing the evolution of the ensemble averaged Wigner distribution matrix of the system is made possible. The resulting radiative transfer equations, expressed in modified Stokes parametric representation, take into account the effects of polarization, refraction, dispersion, and the scattering induced interconversion of transverse and longitudinal waves. The coefficients which appear in these equations are expressed systematically in terms of the electrodynamical and statistical characteristics of the medium. Specialized, these results reproduce Chandrasekhar's equation of transfer for partially polarized radiation in a discrete electron scattering atmosphere.
Dissert. Abstr.

N81-26916 Miami Univ., Coral Gables, Fla.
AMPLITUDE MODULATED ACTIVE TECHNIQUES FOR ELECTRON DENSITY MEASUREMENT IN IONIZED GAS PLASMAS Ph.D. Thesis
William Franklin Moore 1980 106 p
Avail: Univ. Microfilms Order No. 8111664

An active technique for electron density measurements in ionized gas plasmas is described. The technique employs an amplitude modulated carrier signal to probe in the plasma. The modulation frequency is determined by the effective length of a delay-line oscillator's feedback path, part of which includes the plasma. In contrast with other active diagnostic techniques, adjacent-mode competion is avoided by allowing the modulating signal's wavelength to be equal to the effective delay-line length. Fabry-Perot reflections occurring in the modulated segment which lead to fringes in the oscillator's frequency data are analyzed. A microwave carrier is used for experimental verification of the predicted results, although IR or visible carriers are expected to give improved performance.
Dissert. Abstr.

N81-26917 Pennsylvania State Univ., University Park.
AN EXPERIMENTAL STUDY OF THE TRANSIENT LOSS OF PLASMA FROM A THETA PINCH HAVING AN INITIALLY REVERSED MAGNETIC FIELD Ph.D. Thesis
John Edward Heidrich 1980 282 p
Avail: Univ. Microfilms Order No. 8105738

The results of an experimental study of the transient loss of plasma from a 25-cm-long theta pinch initially containing a reversed trapped magnetic field are presented. Local diagnostics with a temporal ressolution of 0.1 microns allow the physics affecting the plasma loss to be identified with a spatial resolution of less than 1 cm. Direct, independent measurements were made of plasma diamagnetism, luminosity, magnetic fields, electron densities, electron temperatures, and impact pressure. Impact pressure data are combined with local density data to yield flow velocities.
Dissert. Abstr.

N81-26918 California Univ., Davis.
THE ALTERNATING DIRECTION IMPLICIT NUMERICAL SOLUTION OF THE TIME-DEPENDENT, 3-DIMENSIONAL RESISTIVE SINGLE FLUID MAGNETOHYDRODYNAMIC EQUATIONS Ph.D. Thesis
Charles Henry Finan, III 1980 248 p
Avail: Univ. Microfilms Order No. 8111992

Resistive magnetohydrodynamics (MHD) is described by a set of eight coupled, nonlinear, three dimensional, time dependent, partial differential equations. A computer code implicit MHD program was developed to solve these equations numerically by the method of finite differences on an Eulerian mesh. In this model, the equations are expressed in orthogonal curvilinear coordinates, making the code applicable to a variety of coordinate systems. The Douglas-Gunn algorithm for alternating direction implicit temporal advancement is used to avoid the limitations in timestep size imposed by explicit methods. The equations are solved simultaneously to avoid synchronization errors.
Dissert. Abstr.

N81-26919# Maryland Univ., College Park. Dept. of Physics and Astronomy.
DYNAMICS OF LASER DRIVEN, ABLATIVELY ACCELERATED TARGETS
Jacob Grun Washington NRL 8 May 1981 91 p refs Sponsored by Navy
(AD-A098883; NRL-MR-4491) Avail: NTIS HC A05/MF A01 CSCL 18/1

The characteristics of ablation plasma from planar targets, driven by long Nd:glass laser pulses (4 nsec, - 10 to the 14th power w/sq cm), and the velocity of the ablatively accelerated targets are experimentally studied. Ablation plasma diagnostics include arrays of time-of-flight ion collectors, plasma calorimeters, and ballistic pendula which directly measure the plasma velocity, energy, and momentum. The ballistic pendula have been tested and calibrated in the experimental environment. A novel double-foil technique has been developed and used to study the velocity of the accelerated target. Using measurements of plasma energy, velocity, and momentum, we determined the scaling with irradiance and the absolute magnitudes of the ablation pressure, velocity and ablation depth (or mass ablation rate). These results are insensitive to laser spot-size effects that may introduce error under some experimental conditions. They imply that the hydrodynamic efficiency and initial thickness of targets accelerated to fusion velocities are weak and strong functions of absorbed irradiance respectively. Thus, target thickness and irradiance may be varied as necessary to alter the pellet-aspect-ratio or to increase laser nonuniformity smoothing with only small changes in hydrodynamic efficiency. We have determined that the accelerated target is composed of a high pressure, high density region preceeded by a low pressure, low density plasma. We have measured the velocity of the high density region and found that it agrees with target velocities predicted from the ablation parameters using a simple rocket model. We accelerated targets over distances many times their own thickness to velocities of 100 km/sec with no apparent breakup.
GRA

N81-26920# Naval Research Lab., Washington, D. C. Laser Plasma Branch.
OBSERVATION OF SPICULES IN X-RAY EMISSION FROM LASER-IRRADIATED TARGETS
M. J. Herbst, R. R. Whitlock, and F. C. Young 15 May 1981 15 p refs
(AD-A098884; NRL-MR-4437) Avail: NTIS HC A02/MF A01 CSCL 20/9

X-ray images of laser-irradiated solid targets show spicular structures in the blowoff plasma. Higher density is inferred in the structures, which seem to follow the fluid flow from the target. An explanation involving localized fast electron production is offered.
Author (GRA)

N81-26921# JAYCOR, Alexandria, Va.
TIME-DEPENDENT ION DIODE PHYSICS AND ION BEAM TRANSPORT IN STABILIZED PLASMA CHANNELS Final Report, 19 Jul. 1979 - 30 Apr. 1980
Frederick L. Sandel 31 Jan. 1981 56 p refs
(Contract N00173-79-C-0449)
(AD-A098888; JAYCOR-PSD-200-81-001-FR) Avail: NTIS HC A04/MF A01 CSCL 20/9

This report summarizes work performed by JAYCOR which has led to significant advances in the understanding of ion diode physics as well as new knowledge of the processes of ion beam transport in the stabilized plasma channel systems previously developed by JAYCOR. The report is divided into three sections. Part A is a comprehensive study of the pinch-beam ion diode. This work was expanded considerably beyond the original scope

of the contract and includes studies of anode materials, anode plasma behavior, time-dependent ion beam profiles, beam bunching, ion species and beam neutralization. Part B is a detailed analysis of plasma channel transport experiments in which previously unknown ion energy losses were discovered in the ion diode and/or focusing regions. Part C is a collection of abstracts of papers written during the period of this work. GRA

N81-26922# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

STUDY OF GEOMAGNETIC STORMS, SOLAR FLARES, AND CENTERS OF ACTIVITY IN 1976, THE YEAR BETWEEN SOLAR ACTIVITY CYCLES 20 AND 21

E. Ruth Hedeman and Helen Dodson Prince 2 Sep. 1980 15 p refs

(Contracts N00024-78-C-5384; MIPR-FY-21790-0011; AF Proj. 2311)

(AD-A098936; SCIENTIFIC-1; AFGL-TR-80-0267) Avail: NTIS HC A03/MF A01 CSCL 03/2

Solar and geophysical circumstances prior to the 34 principal geomagnetic storms in 1976 have been evaluated. In this year of sun spot minima, 21 of the storms were unambiguously classified as sequential. For 7 of the storms prior flares may have played a role. Six of the storms remain as 'problem' situations. The 3 most severe storms in 1976 were associated with the 3 flares in 1976 with Comprehensive Flare Indices + or - 10. Inspection of plots of daily geomagnetic character figures suggest that at least 6 different sequences contributed to the geomagnetic disturbance in 1976. Relationships were sought between inferred coronal holes and the observed locations of significant centers of activity as the possible origins of the sequential storm particles. All of the major recurrent storm sequences in 1976 apparently had at their roots significant centers of activity that could have been near the perimeters of deduced associated coronal holes. The sequential storms occurred as the active regions were dying and continued long after all optical events of the active regions had disappeared. Author (GRA)

N81-26923# General Atomic Co., San Diego, Calif.

MAGNETIC FUSION ENERGY PROGRAM Summary Progress Report, 1 Oct. 1978 - 30 Sep. 1979

Dec. 1980 554 p refs

(Contract DE-AT03-76ET-51011)

(GA-A-16098) Avail: NTIS HC A24/MF A01

Research and experimentation directed at developing magnetic fusion is reviewed. Progress in physics experiments conducted in Doublet 2A and Doublet 3 and also on ISX-B is reported. Also covered are developments in plasma magnetohydrodynamic and kinetic theory, advances in the configuration and operation of the User Service Center of the National Magnetic Fusion Energy Computer Center Network, the development of plasma instrumentation, and studies of possible future fusion reactor materials and components as well as overall configurations for future reactors. DOE

N81-26924# Los Alamos Scientific Lab., N. Mex.

OBSERVATIONS OF PLASMA TEARING INSTABILITIES AND ASSOCIATED AXIAL TRANSLATION IN FIELD REVERSED EXPERIMENTS

W. T. Armstrong, J. C. Cochrane, J. Lipson, and M. Tuszewski Feb. 1981 55 p refs

(Contract W-7405-eng-26)

(LA-8729-MS) Avail: NTIS HC A04/MF A01

Tearing and reconnection processes during the formation and quiescent periods of a field-reversed configuration are studied with an axial array of compensated diamagnetic loops. Several representative plasma shots are documented. DOE

N81-26925# Los Alamos Scientific Lab., N. Mex.

METHOD OF INFERRING THE MAGNETIC FIELD PROFILES IN THE REVERSED-FIELD PINCH

R. Gerwin Mar. 1981 14 p refs

(Contract W-7405-eng-36)

(LA-8738-MS) Avail: NTIS HC A02/MF A01

A diagnostic procedure is proposed that displays the toroidal and poloidal magnetic field profiles in the form of power series, through r (6). In addition to the usual external measurements, only internal point magnetic measurement is required, if cylindrical symmetry and pressure balance are assumed. (The plasma pressure profile is also assumed to be measured nonintrusively; alternatively, it might be ignored if beta is known to be sufficiently small). The (zero-beta) method is tested against full magnetic-profile shot-average data obtained from a multiple-probe device in ZT-40 a ceramic liner. The agreement is quite good. The procedure seems simple enough for on-line use in reverse field pinch (RFP) experiments. The availability of such profiles should enhance the effective application of theory to the RFP. DOE

N81-26926# Los Alamos Scientific Lab., N. Mex.

COMPACT-TOROID FUSION REACTOR BASED ON THE FIELD-REVERSED THETA PINCH

R. L. Hagenson and R. A. Krakowski Mar. 1981 126 p refs

(Contract W-7405-eng-36)

(LA-8758-MS) Avail: NTIS HC A07/MF A01

Early scoping studies based on approximate, analytic models were extended on the basis of a dynamic plasma model and an overall systems approach to examine a compact toroid (CTOR) reactor embodiment that uses a field-reversed theta pinch as a plasma source. The field-reversed plasmoid would be formed and compressionally heated to ignition prior to injection into and translation through a linear burn chamber, thereby removing the high-technology plasmoid source from the hostile reactor environment. Stabilization of the field-reversed plasmoid would be provided by a passive conducting shell located outside the high temperature blanket but within the low field superconducting magnets and associated radiation shielding. On the basis of this batch-burn but thermally steady-state approach, a reactor concept emerges with a length below approx. 40 m that generates 300 to 400 MWe of net electrical power with a recirculating power fraction less than 0.15. DOE

N81-26927# Science Applications, Inc., La Jolla, Calif. Lab. of Applied Plasma Studies.

STUDIES OF EMISSION AND TRANSPORT OF SYNCHROTRON RADIATION IN TOKAMAKS

S. Tamor 16 Mar. 1981 26 p refs

(Contract DE-AC03-76FT-53057)

(LAPS-71; SAI-023-81-110LJ) Avail: NTIS HC A03/MF A01

An elementary qualitative discussion is given of the transport of synchrotron radiation in a magnetized plasma. A summary is given of the actual computational results. The conclusions to be drawn with respect to both the physics of advanced fuel reactors and better computational methods are outlined. DOE

N81-26928# Oak Ridge National Lab., Tenn.

THE 3-D NONLINEAR CALCULATIONS OF RESISTIVE TEARING MODES

H. R. Hicks, J. A. Holmes, D. K. Lee, B. Carreras, and B. V. Waddell Mar. 1981 56 p refs

(ORNL/TM-7132) Avail: NTIS HC A04/MF A01

The nonlinear, 3-D, initial value computer code RSF is described. This code assumes cylindrical geometry with a Fourier series representation in the two periodic coordinates and a finite difference representation in the radial direction. This choice makes RSF considerably more accurate and efficient than previous codes. DOE

N81-26929# Oak Ridge National Lab., Tenn.

VARIATIONAL MOMENT SOLUTIONS TO THE GRAD-SHAFRANOV EQUATION

L. L. Lao, S. P. Hirshman, and R. M. Wieland Mar. 1981 48 p refs

(Contract W-7405-eng-26)

(ORNL/TM-7616) Avail: NTIS HC A03/MF A01

A variational method is developed to find approximate solutions to the Grad-Shafranov method is developed to find approximate solutions to the Grad-Shafranov equation. The surface of the constant poloidal magnetic flux psi (R,Z) are obtained by solving a few ordinary differential equations, which are moments of the Grad-Shafranov equation, for the Fourier amplitudes of the inverse mapping R(psi, theta) and Z(psi, theta). Analytic calculations using the Impurity Study Experiment and the Engineering Test Facility/International Tokamak Reactor geometries are performed numerically, and the results agree well with those calculated using standard two dimensional equilibrium

codes. The main advantage of the variational moment method is that it significantly reduces the computational time required to determine two dimensional equilibria without sacrificing accuracy. DOE

N81-26930# Wesleyan Univ., Middletown, Conn.
COLLISION CROSS SECTIONS AND EQUILIBRIUM FRACTIONS OF IONS AND ATOMS IN METAL VAPOR TARGETS *Project Progress Report, 1 Jun. 1979 - 31 May 1980*
T. J. Morgan 1980 7 p refs
(Contract DE-AS02-76ET-53048)
(DOE/ET-53048/3) Avail: NTIS HC A02/MF A01

In connection with the development of double charge exchange D(-) ion sources, the measurement D(-) formation cross sections in alkaline-earth metal vapor targets is discussed. Specifically, electron transfer cross sections for 3 to 40 keV D(+) ions and D(0) atoms in collision with calcium vapor were measured. DOE

N81-26931# California Univ., Livermore. Lawrence Livermore Lab.
MICROSPHERE ROTATOR FOR AUTOMATED INTERFEROMETRIC TARGET CHARACTERIZATION
J. A. Monjes, B. W. Weinstein, D. L. Willenbord, and A. L. Richmond 19 Jan. 1981 28 p refs Presented at Topical Meeting on Inertial Confinement Fusion, San Diego, Calif., 26 Feb. 1980
(Contract W-7405-eng-48)
(UCRL-83375; CONF-800208-27) Avail: NTIS HC A03/MF A01

The mechanical and analytical design of a microsphere rotator (TOPO II) used in the automated interferometric surface characterization of laser fusion targets is described. The interferometer rapidly and systematically characterizes transparent laser fusion targets with regard to spherical surface figure and uniform wall thickness. The mechanical microsphere rotator allows the interferometer to systematically scan the entire surface of the target. DOE

N81-26932# California Univ., Livermore. Lawrence Livermore Lab.
DOUBLE-SHELL INERTIAL CONFINEMENT FUSION TARGET FABRICATION
C. W. Hatcher, L. E. Lorensen, and B. W. Weinstein 26 Aug. 1980 20 p refs Presented at the Am. Vacuum Soc. Conf., Detroit, 13 Oct. 1980
(Contract W-7405-eng-48)
(UCRL-84472; CONF-801037-38) Avail: NTIS HC A02/MF A01

First generation hemishells, from which spherical shells are constructed, were fabricated by micromachining coated mandrels and by molding. The remachining of coated mandrels are described in detail. Techniques were developed for coating the microsized mandrels with polymeric and metallic materials by methods including conformal coating, vapor deposition, plasma polymerization and thermoforming. Micropositioning equipment and bonding techniques were developed to assemble the hemishells about a fuel pellet maintaining a spherical concentricity of better than 2 microns and voids in the hemishell bonding line of a few hundred angstroms or less. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N81-26933 American Univ., Washington, D. C.
INTERFACE STATES IN 3-5 COMPOUND SEMICONDUCTOR MOS DEVICES Ph.D. Thesis
Edward Richard Blazejewski 1980 146 p
Avail: Univ. Microfilms Order No. 8110112

The electrical characteristics of the interface between an anodic native oxide of GaAs formed in tartaric acid, water and propylene glycol and GaAs itself were studied. In particular, the energy distribution of the interface state density of the native oxide GaAs system was investigated. The MOS capacitors are fabricated from n(100), n(111)B, and p(100) material. The Ta2O5/native oxide passivation layer was also studied. Variable frequency capacitance and conductance measurements as a function of bias were used to determine interface state density. In particular, the quasistatic and conductance methods were employed. The devices exhibit hysteresis due to electron injection into the oxide and anomalous frequency of the accumulation capacitance. These effects are shown to be consistent with the interface state and oxide trap model. The surface potential as a function of applied bias is also determined and is found to restrict the Fermi level to the lower half of the bandgap. The range of allowed Fermi level movement is .43 eV. Minimum densities of 10 to the 12th power/eV/cu cm are found while no maximum is detected. Dissert. Abstr.

N81-26934 Michigan State Univ., East Lansing.
TRANSPORT PROPERTIES OF Cd AND W Ti(1+X)S2 AND Al AT LOW TEMPERATURES Ph.D. Thesis
Brent J. Blumenstock 1980 159 p
Avail: Univ. Microfilms Order No. 8112050

The magnetothermopower of Cd and W single crystals, the electrical resistivity, Hall coefficient, and magnetoresistivity of crystalline Ti(1+x)S2, and the electrical resistivity of polycrystalline Al are investigated. The magnetothermopower Sa of Cd and W single crystals between 1.5 and 4.2 K was measured. At the lowest temperatures, the magnetothermopower showed no sign of saturating in magnetic fields up to our limiting field of 50 kG. A reinterpretation of high field semiclassical theory is presented. The electrical resistivity, the Hall coefficient and the magnetoresistance of Ti(1+x)S2 single crystals were measured over the temperature range of 1.5 to 100 K. The carrier concentration was found to increase slightly with decreasing temperature. The residual resistivity was found to vary as n to the 1/3 power. The magnetoresistance of Ti(1+x)S2 is largely temperature independent over this temperature range and is strongly sample dependent. The temperature dependence of the electrical resistivity of polycrystalline Al extends down to approximately 0.2 K. Dissert. Abstr.

N81-26935 Pittsburg Univ., Pa.
HEAT CAPACITY STUDIES OF CRYSTAL FIELD EFFECTS IN RARE-EARTH-IRON INTERMETALLIC COMPOUNDS Ph.D. Thesis
Don Joseph Germano 1980 251 p
Avail: Univ. Microfilms Order No. 8112598

The heat capacity of the RFe2 compounds (R = Gd, Tb, Dy, Ho, Er, Tm and Lu) and the pseudobinary compound Ho(06)Tb(0.4)Fe2 was studied and throughout the temperature region 4.2 to 300 K. Crystal field intensity parameters and the energy level diagrams for the rare earth ions were determined. In addition, the magnetocrystalline free energies, rare earth ion magnetic moment and bulk anisotropy constants were obtained for these compounds as a function of temperature. In the pure RFe2 compounds, the delta S exp/delta S calc values at 300 K increase with increasing atomic weight of the rare earth element indicating that thermal excitation of the heaviest rare earth ions over the energy levels of the ground state is nearly complete at the maximum temperature of this study. A trend is also evident in the magnetic anisotropies of the RFe2 compounds. The HOTbFe2 compound exhibits a spin reorientation transition in the region of 125 K which appears to be a cooperative effect. Dissert. Abstr.

N81-26936 Brown Univ., Providence, R. I.
STUDY OF SOLID HELIUM-4 BY PLASTIC DEFORMATION AND ULTRASONIC METHODS Ph.D. Thesis
Hegeon Kwun 1980 130 p
Avail: Univ. Microfilms Order No. 8111131

The results of plastic deformation experiments and of measurements of the nonlinear behavior of ultrasonic propagation in the bcc and hcp phases of solid helium-4 are presented. Plastic deformation experiments include the measurements of stress-strain relations, strain rate dependence of flow stress as a function of temperature, and ultrasonic attenuation changes during the deformation. These measurements were intended to investigate the characteristics of the motion of point defects

and of dislocations in solid helium-4, and were motivated by the possibility of quantum effects in the migration of these defects. Dissert. Abstr.

N81-26937 Yale Univ., New Haven, Conn.
TRANSPORT PROPERTIES OF n-TYPE SILICON INVERSION LAYERS IN MOSFET STRUCTURES AT LOW TEMPERATURES Ph.D. Thesis
Kit Man Cham 1980 175 p
Avail: Univ. Microfilms Order No. 8110020

The transport properties of n-type silicon inversion layers in MOSFET structures at liquid helium temperatures is studied in detail. Precision measurements of the temperature dependence of the resistivity from 1 to 5 K were made. The temperature dependence was studied as a function of electron density, substrate bias, device quality, and device geometry. For electron densities below 2 x 10 to the 12th power sq cm, the resistivity increases with increasing temperature. This behavior was shown to be primarily due to Coulomb scattering and possibly also due to surface roughness scattering. At electron densities above 6 x 10 to the 12th power sq cm, the resistivity increases almost logarithmically with decreasing temperature. This is suggested to be due to localization effects or interaction effects in the impurity scattering, depending on the sample quality. It is suggested that for the whole range of electron densities under investigation, the temperature dependence of the resistivity be described by the combination of a linear term and a logarithmic term due to the above mentioned mechanisms. Electron-phonon interaction was studied through warm electron effects.
Dissert. Abstr.

N81-26938 Yale Univ., New Haven, Conn.
DYNAMIC PROPERTIES OF SUPERCONDUCTING MICROBRIDGES Ph.D. Thesis
Mark David Feuer 1980 266 p
Avail: Univ. Microfilms Order No. 8110030

Superconducting microbridges of Pb alloys were studied in both the uniform thickness and variable thickness geometries. Variable-thickness microbridge of pure In were also studied, to investigate the effect of a long electron mean free path and a long superconducting coherence length. Measurements of the time averaged voltage as a function of the current bias, performed at various power levels of microwave irradiation, yield information about the Josephson effect, Joule heating, and other phenomena of the dynamic (i.e., finite-voltage) state. Critical current data, representative of the static state, were also examined. A photolithographic process incorporating ion-beam etching techniques were developed to permit fabrication of microbridges with all bridge dimensions less than or equal to 500 nm.
Dissert. Abstr.

N81-26939 Cornell Univ., Ithaca, N. Y.
ELECTRODYNAMIC RESPONSE OF INHOMOGENEOUS MEDIA Ph.D. Thesis
Peter Steven Garik 1981 167 p
Avail: Univ. Microfilms Order No. 8110863

The electrodynamic response of two inhomogeneous systems characterized by their broken translational symmetry was examined. The first model system considered was bounded jellium. This model allowed for study of the effects of the presence of a surface on electrodynamic response. The second model examined the effects of the periodic crystal potential. Both models were examined in the random phase approximation with an emphasis in the calculations on the response of simple metals.
Dissert. Abstr.

N81-26940 Cornell Univ., Ithaca, N. Y.
SMALL-AREA NIOBIUM TUNNEL JUNCTIONS WITH REACTIVE ION BEAM OXIDATION Ph.D. Thesis
Alan Willis Kleinsasser 1981 233 p
Avail: Univ. Microfilms Order No. 8110897

A reactive ion beam technique was developed for the growth of the oxide tunnel barrier, and an edge geometry was employed which allowed junctions to be formed on the ion mill patterned edges of thin Nb films. The relatively high T sub c of niobium and the durability of tunnel junctions with niobium base electrodes make it a desirable material for junction fabrication. The drawbacks connected with this material are the relatively large dielectric constant of its principal oxide and the difficulty of achieving high junction quality with niobium oxide tunnel barriers. The RF plasma oxidation method, the best presently available technique, is limited by the scattering of impurities in the glow discharge. Reliable production of high quality junctions is possible only if all system parameters are carefully controlled. The reactive ion beam oxidation technique developed requires a much lower operating pressure, thereby eliminating the problem of impurity scattering. Extremely high quality junctions were produced by this method. Dissert. Abstr.

N81-26941 Cornell Univ., Ithaca, N. Y.
VISCOSITY AND CRYSTALLIZATION KINETICS OF As2Se3 Ph.D. Thesis
Donald Wesley Henderson 1981 150 p
Avail: Univ. Microfilms Order No. 8110870

The crystallization kinetics, viscosity, and temperature coefficient of expansion of amorphous As2Se3 were investigated. The crystallization kinetics As2Se3 are characterized under isothermal conditions for undercoolings ranging from 37 C to 122 C using thermal analysis techniques. Under the imposed experimental conditions the crystallization kinetics can be accurately described by the Johnson-Mehl-Avrami transformation equation. At least in certain temperature regions As2Se3 exhibits an increasing nucleation rate with respect to time. Microscopic examination of partially crystallized specimens revealed constant isothermal growth rates and a spherulitic growth habitat for the crystalline phase. Necleation of all spherulites occurred at free surfaces. The individual As2Se3 crystallites in the spherulites demonstrate a plate like growth morphology at temperatures well below the crystalline melting point. At temperatures approaching the crystalline melting point the crystallites demonstrate a rod like growth morphology. Dissert. Abstr.

N81-26942 Carnegie-Mellon Univ., Pittsburgh, Pa.
KINETICS OF INTERCALATION OF GRAPHITE AND PHASE TRANSITIONS IN GRAPHITE-BROMINE Ph.D. Thesis
Kamal Kumar Bardhan 1980 141 p
Avail: Univ. Microfilms Order No. 8107871

Graphite intercalation compounds are discussed. A model of first rapid intercalation is presented to describe the kinetics of intercalation. The model applies to interface-controlled intercalation, as for the intercalation of Br2 and other similar intercalates. In this model intercalation proceeds by layer-by-layer nucleation and subsequent inplane growth. A time gap is assumed between the nucleation of two successive intercalate layers. Of particular importance is that, surface profilometry was used for the first time to study the kinetics of intercalation. Furthermore in situ X-ray diffraction study of the evolution of stages during intercalation was carried out to get direct information about the structural aspects. Graphite-bromine was chosen for the investigation of the ordering in the intercalate layers in residue compounds by X-ray scattering. A phase transition, believed to be of commensurate incommensurate type, was found.
Dissert. Abstr.

N81-26943 Pittsburg Univ., Pa.
THE ELECTRODYNAMICAL PROPERTIES OF JOSEPHSON JUNCTIONS Ph.D. Thesis
Daniel R. Bunce 1980 92 p
Avail: Univ. Microfilms Order No. 8112583

A fully quantized formalism for calculating the radiation properties of Josephson junctions is presented. The electrons in a weak superconductor interact with the radiation field via minimum coupling which is developed through perturbation theory. The perturbation expansion is carried out in the Heisenberg picture. The properties of the Heisenberg expansion are illustrated by calculating the radiation rate for a single excited atom and remarks comparing the Heisenberg picture with the more usual Dirac (interaction) picture are made. Superconductivity is reviewed and the theory modified to model a system of two weakly coupled superconducting regions (a Josephson junction). Dissert. Abstr.

N81-26944 Indiana Univ., Indianapolis.
VAN DER WAALS INTERACTION BETWEEN AN ATOM AND A CYLINDER Ph.D. Thesis
Michael John Mehl 1980 351 p
Avail: Univ. Microfilms Order No. 8112493

Observation of the scattering of neutral atoms by a metal cylinder shows a serious disagreement between theory and experiment. After using classical scattering theory to confirm the experimental analysis, the Van der Waals force between atom and a solid was reexamined. The atom-solid potential was studied using a variety of models for the solid, including layered media, non-local dielectric response, and rough surface effects. In no case is the potential changed enough to account for the discrepancy between theory and experiment. The scattering event was reanalyzed using quantum mechanics. After justifying several approximations an expression was derived for the scattering intensity as a functional of the phase shifts. The WKB approximation produces an intensity which oscillates slowly about the classical result, indicating that a classical description is not valid. Dissert. Abstr.

N81-26945 Oregon Univ., Eugene.
TUNNELING AND LIFETIME EFFECTS IN TIPPED SILICON INVERSION LAYERS Ph.D. Thesis
Thomas George Matheson 1980 160 p
Avail: Univ. Microfilms Order No. 8109691

The Fourier spectrum of Shubnikov - de Haas oscillations in Si MOSFETs tipped slightly from [001] was examined. The field-sweep spectrum was found to display peaks which corresponded exactly to the combination orbits expected from electron tunneling across the minigap. The relative amplitudes of the orbits followed the variation of the size of the minigap with electron density. Digital filtering of he oscillations was used to separate the orbits and investigate the appropriateness of semiclassical magnetic-breakdown theory. Breakdown fields were estimated from the ratio of the circle and lens oscillations and compared to values calculated from optical measurements. A significant disagreement was found between the two. The relative amplitudes of the various breakdown orbits did not fit magnetic-breakdown-theory predictions. The shape of the envelopes of the oscillations was not dominated by breakdown effects, but rather by lifetime effects. Electron quantum lifetimes of various orbits were measured, and were found to increase with increasing orbit size. Dissert. Abstr.

N81-26946 Brown Univ., Providence, R. I.
PHOTOINDUCED ABSORPTION IN AMORPHOUS TETRAHEDRALLY-BONDED SEMICONDUCTORS Ph.D. Thesis
Paul OConnor 1980 255 p
Avail: Univ. Microfilms Order No. 8111154

A photoinduced transient absorption (PA) was observed and studied in amorphous semiconductors and alloys prepared by methods which incorporate hydrogen. The absorption arises from transitions between holes trapped at deep lying defects and the valence band. In a Ge:H the PA spectrum consists of an isolated symmetric band and the absorption mechanism is interpreted as photon assisted hopping of small polarons bound to defects with a binding energy of 0.35 - 0.40 eV. Recombination of these excitations is found to follow bimolecular diffusion limited kinetics. The electron drift mobility can be determined from the recombination rate and is a decreasing function of time following pulsed excitation. Dissert. Abstr.

N81-26947 Brown Univ., Providence, R. I.
AUGER ELECTRON SPECTROSCOPY STUDIES OF SURFACE KINETICS Ph.D. Thesis
Gregory Alan Robertshaw 1980 253 p
Avail: Univ. Microfilms Order No. 8111170

Auger electron spectroscopy (AES) based techniques were developed to study the kinetics of surface processes which involve a conversion from one adsorbate state to another without necessarily causing any corresponding change in the gas phase. The sensitivity of Auger spectra to the chemical environment of an adsorbate complex was exploited to permit conversions to be monitored both as a function of increasing sample temperature (thermal conversion spectroscopy (TCS)) and at fixed temperatures as a function of time (isothermal conversion). These techniques, in conjunction with conventional AES and thermal desorption spectroscopy (TDS), were employed in an investigation of the reaction kinetics of C2H4 on W(100) between 300 K and 1200 K. Similar investigations of C2H4 on W(110) and W(111) using TCS, TDS, and AES were performed and a preliminary model based on a two stage decomposition process is presented. Dissert. Abstr.

N81-26948 Cornell Univ., Ithaca, N. Y.
ELECTRON ENERGY LOSS STUDY OF THE OPTICAL PROPERTIES OF ANISOTROPIC THIN FILM BORON-NITRIDE Ph.D. Thesis
Alan Benjamin Ray 1981 141 p
Avail: Univ. Microfilms Order No. 8110987

Electron energy loss spectroscopy is used as a probe of the optical properties of the highly anisotropic compound, hexagonal boron nitride. Two sets of measurements are performed. When scattering through moderate (1 micro radian) angles is measured, it is possible to interpret the results in terms of the nonretarded bulk energy loss function. These measurements are used to derive the tensor dielectric function for long wavelength excitations as a function of energy. The second set of measurements serves as a means for improving the dielectric function derived above. These are very high angular resolution (8 micro radian) small angle scattering spectra. First, bulk plasmons are present at three separate energies. They show a strong dependence on the angle between the wavevector transfer and the unique axis (c axis) of the crystal. Calculations of the small angle spectra based upon the dielectric functions derived from the moderate angle spectra show a broad surface plasmon and sharp structures due to surface guided modes and Cherenkov radiation. It is seen that the surface guided modes can quench strong Cherenkov peaks.
Dissert. Abstr.

N81-26949 Brown Univ., Providence, R. I.
THE ADSORPTION AND DISSOCIATION OF CARBON MONOXIDE ON THE MOLYBDENUM (100) SURFACE Ph.D. Thesis
Stephen Semancik 1980 230 p
Avail: Univ. Microfilms Order No. 8111178

A technique based on UV photoelectron spectroscopy (UPS) was developed which can directly monitor the decomposition of certain molecular adsorbates. It was used to investigate the thermally induced dissociation of submonolayer amounts of carbon monoxide on the (100) surface of molybdenum. Results from both temperature ramped and isothermal experiments on the Mo(100)/CO system yield an activation energy for CO dissociation that is near 0.60eV. The rate at which dissociation occurs was found to decrease rather sharply as the total surface coverage increases, indicating that the process does not obey simple first order kinetics. The rate change can be explained, however, by a coverage-dependent activation energy which increases with total surface coverage. Dissert. Abstr.

N81-26950 Duke Univ., Durham, N. C.
TRANSPORT PHENOMENA IN He3-He4 MIXTURES NEAR THE TRICRITICAL POINT Ph.D. Thesis
George Ruppeiner 1980 130 p
Avail: Univ. Microfilms Order No. 8112315

Measurements of transport phenomena in He3-He4 mixtures near the tricritical point and along the superfluid transition line at saturated vapor pressure are discussed. The He3 mole fraction X ranged from 0.51 to 0.72 and the temperature from 0.8 to 1.6 K. Results for the thermal diffusion ratio k sub T and the thermal conductivity kappa both in the normal fluid and in the superfluid are presented. In the tricritical region, k sub T was found to diverge strongly as the tricritical point was approached; no singularity in kappa was found. In the region near the lambda line, kappa remains finite, as expected, but kappa sub T appears to have a stronger singularity than predicted by theory. The analysis of the experiment in the normal fluid for mixtures with $X > 0.51$ was complicated by superfluid film flow along the walls of the sample cell. This effect is described and analyzed with Khalatnikov's theory of superfluidity. However, for the mixture $X = 0.51$, where there is no such film flow, the behavior of k sub T is consistent with predictions. Dissert. Abstr.

N81-26951 Cornell Univ., Ithaca, N. Y.
SUPERFLUID DYNAMICS IN TWO DIMENSIONS Ph.D. Thesis
Stephen Lewis Teitel 1981 137 p
Avail: Univ. Microfilms Order No. 8110967

The dynamic properties of superfluid Helium 4 in thin films

are investigated, where two dimensional behavior is expected. The static dynamic theories of two dimensional superfluidity are reviewed. The dynamics of bound vortex pairs in an applied oscillating field are studied. One of the simple intuitive approximations contained in the dynamic theory is justified. Dynamic theory is applied to torsional oscillator, third sound, and heat conduction experments. Dissert. Abstr.

N81-26952 California Univ., San Diego.
MEASUREMENT OF THE ELECTRON SPIN SUSCEPTIBILITY IN COPPER AND LITHIUM USING A NEW APPLICATION OF CONDUCTION ELECTRON SPIN RESONANCE IN BILAYERS Ph.D. Thesis
David William Tolleth 1981 63 p
Avail: Univ. Microfilms Order No. 8111900

Conduction electron spin resonance, (CESR), in metal bilayers is used as a technique to measure the electron spin susceptibilities of copper and lithium. This technique potentially expands the number of elements for which spin susceptibilities can be measured to include all elements in which CESR can be observed. The CESR resonant frequency of a metal bilayer in which motional narrowing of the constituent Larmor precession frequencies can be achieved is shown to have a particularly simple dependence on the ratio of the electron spin susceptibilities of the two metals. The task of measuring the weak and thus difficult to measure electron spin susceptibility is reduced to one of measuring the position of a CESR line. Using sodium and potassium as susceptibility standards, zeta's of lithium and copper are found to be 2.87 + or - .29 and 1.35 + or - .12 respectively.
Dissert. Abstr.

N81-26953 California Univ., Santa Barbara.
THE MECHANICAL RESPONSE OF SINGLE CRYSTAL HgI2 Ph.D. Thesis
Timothy Walton James 1980 141 p
Avail: Univ. Microfilms Order No. 8108364

The mechanical properties of single crystal HgI2 were studied both microscopically, by means of etch pit techniques, and macroscopically by means of deformation tests. A dislocation etchant was developed which consisted of trichloroethelene and 5% ethanol. Etch pits on (001) faces of single crystal HgI2 that are associated with dislocations were identified. The macroscopic deformation tests revealed a number of results, viz. (1) deformation is very easy on the (001) planes; (2) the deformation on (001) planes exhibits a yield stress and work-hardening; (3) thermally activated creep is active also on the (001) planes; (4) there is a limited effect of temperature on the deformation behavior; and (5) specimens that were stressed such that they could not experience slip on (001) planes fractured in a brittle manner. From these results a dislocation model is proposed in which the dislocation structure of HgI2 is made up of two vastly different types of dislocations one which is easily moved and active on the (001) slip planes and a second that is very difficult to move and is present on (100) type slip planes. Dissert. Abstr.

N81-26954 Brown Univ., Providence, R. I.
AN EXPERIMENTAL STUDY OF SHEAR LOCALIZATION IN ALUMINUM-COPPER SINGLE CRYSTALS Ph.D. Thesis
Young Won Chang 1980 106 p
Avail: Univ. Microfilms Order No. 8111081

Localized shearing in fcc single crystals subjected to monotonic loading undergoing symmetric double slip is analyzed and predicted to occur at a critical ratio predicted to lie in the range 0.017 to 0.026. Model predictions are compared to experment. Macroscopic shearing occurred on an apparently non-crystallographic plane and was found to be directly responsible for the final fracture of crystals. Coarse slip bands were developed on either the primary or conjugate slip planes, often accompanied by a load drop. No evidence of strain softening was observed. The effects of local lattice rotations on the formation and initial development of macroscopic shear bands were studied. The X-ray studies revealed that the lattice within the shear bands was finitely rotated from that of the surrounding matrix, and that this rotation was always such as to induce geometrical softening within the bands. The mechanistics of the observed local lattice rotation are explained by dislocation theory.
Dissert. Abstr.

N81-26955 Michigan State Univ., East Lansing.
PROPERTIES OF INTRINSIC AND CO-SPUTTERED HYDROGENATED AMORPHOUS SILICON FILMS AND SCHOTTKY PHOTOVOLTAIC DEVICES Ph.D. Thesis
Mark Gordon Thompson 1980 140 p
Avail: Univ. Microfilms Order No. 8112164

Optical and electrical properties of intrinsic hydrogeneated silicon films were studied as functions of the hydrogen partial pressure in the sputtering atmosphere and the RF input power. Optical energy gap, dark conductivity, and photoconductivity depend critically on these deposition parameters. Also, the quality of the vacuum system, in particular the leak rate as compared to the gas flow rate, is an important quantity in determining film properties. A five fold increase in the ut product, from 1.9 x 10 to the -9th power cu cm/V to 9.6 x 10 to -9th power cu cm/v, is observed going from a 98.6% pure atmosphere to a 99.98% pure atmosphere. Models are suggested to explain the observed behavior of dark and photoconductivity.
Dissert. Abstr.

N81-26956 California Univ., San Diego.
MODIFIED MOMENTS METHODS FOR A STUDY OF THE VIBRATIONAL MOTION OF ATOMS NEAR THE SURFACE OF SOLIDS Ph.D. Thesis
Michael Gene Prais 1981 188 p
Avail: Univ. Microfilms Order No. 8111897

The vibrational motion of atoms near the surface of a solid is quite different from that of atoms in the bulk. The differences can be characterized by vibrational densities of states for these particles. This thesis reports the development of modified moment methods to analyse and reconstruct the local and the wave-vector-dependent densities of states for the motion of particles on a semi-infinie lattice. The modified moments of these densities are calculated by means of a generalization of the modified moment recursion relation used for the infinite lattice. The utility of the modified moments for the calculation of integral averages over densities is shown in the calculation of the mean square displacement of the particles near the (111) surface of a semi infinite face centered cubic crystal with nearest-neighbor central harmonic interactions. An improved quadrature method is introduced which gives greater precision than earlier moments methods. Dissert. Abstr.

N81-26957 City Univ. of New York, N. Y.
PREPARATION AND CHARACTERIZATION OF HYDROGENATED AMORPHOUS CARBON FILMS: ELECTRICAL AND OPTICAL PROPERTIES Ph.D. Thesis
Bernard Steele Meyerson 1981 126 p
Avail: Univ. Microfilms Order No. 8112760

Semiconductor properties of thin amorphous carbon films are investigated. Semiconducting films of hydrogenated amorphous carbon films were prepared via the dc glow discharge of acetylene, at deposition temperatures between 25 and 375 C. The optical absorption and electrical conductivity were measured. It is deduced from these measurements that these films will be graphitic in their electrical and optical properties for deposition temperatures at or above 425 C. Doped films prepared via the incorporation of diborane or phosphine gas into the discharge are studied. For films deposited at 250 C, room temperature conductivity increased when either 1% phosphine or 10% diborane was added to the discharge gas. A shift of the Fermi level of about 0.7 eV was inferred from changes in the activation energy of conduction. The thermopower S of heavily doped samples was measured. The magnitude of S was indicative of a hopping transport mechanism. The thermopower was found to be a nearly linearly increasing function of T. It is concluded that this material holds promise as a semiconductor material. Dissert. Abstr.

N81-26958 Cornell Univ., Ithaca, N. Y.
RENORMALIZATION GROUP APPROACH TO THE X-RAY ABSORPTION PROBLEM AND APPLICATION TO THE VIGMAN-FINKELSHTEIN MODEL FOR MAGNETIC IMPURITIES IN METALS Ph.D. Thesis
Luiz NunesdeOliveira 1981 419 p
Avail: Univ. Microfilms Order No. 8110894

The renormalization group techniques developed by Wilson for the Kondo problem are applied to three related problems. X-ray absorption problem, the metal is represented by a half-filled

conduction band and a deep level representing a core state. The absorption spectrum is calculated and described by a power law. Remarkably small deviations from the Nozieres-De Dominicis power law are found. The X-ray absorption spectrum for the resonant level model for impurities in metals is calculated. In this model, the metal is represented by a half-filled conduction band and the impurity by two levels: a core level and a resonant level coupled to the conduction electrons. Qualitative arguments are presented determining the exponents describing the two power laws approached. Numerical results are presented. The specific heat of dilute magnetic alloys is investigated by analyzing the Vigman-Finkelshtein model. A mapping between this spinless model and the Kondo model for magnetic impurities in metals is established and analyzed. Dissert. Abstr.

N81-26959 California Inst. of Tech., Pasadena.
SOLID-STATE NMR AT HIGH MAGNETIC FIELDS USING MULTIPLE PULSE TECHNIQUES Ph.D. Thesis
Douglas Glenn Carson 1981 202 p
Avail: Univ. Microfilms Order No. 8111492

The proton chemical shift in solids was measured using a homebuilt high field (6.3 tesla) multiple pulse spectrometer. The distinctive features of the spectrometer are described. The chemical shift tensors for the carboxylic protons in potassium hydrogen malonate, potassium hydrogen oxydiacetate, and potassium hydrogen dicrotonate are reported as determined by multiple pulse experiments. The isotropic part of the chemical shifts relative to a spherical sample of TMS and the anisotropies for the three compounds are -20.5(5), -19.6(7), -18.2(7), and 27.6(6), 28.3(9), 28.9(9) ppm respectively. A two pulse double quantum nuclear magnetic resonance (NMR) experiment is described which is designed to measure the Pake doublet splitting in systems of isolated proton pairs which are inhomogeneously broadened. This experiment is applied to the water molecules in the channels of a single crystal of cordierite as a function of orientation and temperature to obtain structural information about the water molecules. Dissert. Abstr.

N81-26960 Cornell Univ., Ithaca, N. Y.
RESISTANCE BEHAVIOR OF ZnS, AlN, SiC AND PMMA UNDER ULTRAHIGH PRESSURE Ph.D. Thesis
Kam-Shui Chan 1981 111 p refs
Avail: Univ. Microfilms Order No. 8110975

The single crystal diamond spherically tipped indentor flat anvil ultrahigh pressure generating system was used to observe insulator to metal transitions in ZnS, AlN, SiC, and PMMA. ZnS was studied by a nonshorting electrical resistance monitoring technique using the interdigitated electrodes. A metallic transition was observed at 14.0 + or - 0.6 GPa. Interdigitated electrodes with finger widths and spacings (both of d) of 12.5, 6, and microns were used in the ZnS work. Electrodes with d = 0.5 microns fabricated by electron beam lithography using PMMA as resist were used to observe the metallic transition in AlN, theoretical predicted at 90 GPa. The coated method where thin metal films were deposited on both the indentor and the flat anvil to act as electrodes produced evidence that AlN remained insulating up to at least 59 GPa. Studies on detached thin films of SiC in the multilayer configuration with the coated method indicated that SiC remained an excellent insulator up to at least 72 GPa. Interdigitated electrodes with ad = 1.25 microns were also used in the SiC work. Pressurization of PMMA showed that PMMA remained highly insulating up to 100 GPa.
Dissert. Abstr.

N81-26961 Brown Univ., Providence, R. I.
SURFACE MAGNETISM OF TRANSITION METALS Ph.D. Thesis
Daniel Ruben Grempel 1980 179 p
Avail: Univ. Microfilms Order No. 8111108

The ground state magnetic properties of the surfaces of transition metals were investigated for a local exchange model. A technique was derived to generate a continuous fraction expansion for the one particle Green's functions and their Pade approximations. By the use of the latter, the bare susceptibility was calculated and the integral equation for the full susceptibility was solved. The formalism was applied to Ni, V and Cr. In the case of Ni it was found that the susceptibility exhibits long range Friedel oscillations whose amplitude is further enhanced by the electron interaction. The effects of this on the stability of the paramagnetic state and on the magnetization profile in the ferromagnetic state are discussed. For V and Cr, the surface magnetic properties are dominated by the appearance of a surface resonance at the Fermi level and, consequently, the surface effect is rapidly screened. In the case of V(100) it is predicted that the surface region carries a net magnetic moment in the ground state. The effects of spin fluctuations at finite temperature were studied for this system. It is found that strong local fluctuations lead to the formation of large localized magnetic moments at the surface. Dissert. Abstr.

N81-26962 Pittsburg Univ., Pa.
NUCLEATION NEAR THE CRITICAL POINT IN A BINARY LIQUID MIXTURE Ph.D. Thesis
Subramanian Krishnamurthy 1980 102 p
Avail: Univ. Microfilms Order No. 8112608

Two experiments on nucleation are reported. In the first experiment the limit of supercooling was measured in a binary mixture of 2,6-lutidine and water (LW) an order of magnitude closer to the critical point than was possible in previous experiments. This adds up to the evidence of enhanced relative supercoolings in fluids near the critical point. A recent theoretical prediction of this effect is also reported. In the second experiment, a microscope was used to study the formation and growth of nuclei in a supercooled mixture of LW close to the critical point. Clear experimental evidence was found of the effect of critical slowing down on the phase separation process in the nucleation regime. These observations account for the anamolously large supercoolings reported in liquids and binary mixtures near the critical point. Dissert. Abstr.

N81-26963 Cornell Univ., Ithaca, N. Y.
CHARGE-DENSITY-WAVES AND SUPERCONDUCTIVITY IN ANISOTROPIC Ph.D. Thesis
John David Kulick 1981 165 p refs
Avail: Univ. Microfilms Order No. 8110974

The inherent instability of low dimensional materials to the formation of charge density waves was studied by its effect on the magnetic susceptibility of several of transition metal trichalcogenides. It is found that a Van Vleck paramagnetic contribution to the susceptibility exists in NbSe3 due to the CDW induced gaps in the Fermi surface. In addition a superconducting transition in NbSe3 at ambient pressure was observed below 2 K. Magneto resistance studies of the transition show that this superconductivity displays a large anisotropy in the critical field and an extremely small critical current density of 0.02 A sq cm. An automated Faraday balance susceptometer was used to magnetic susceptibility measurements in fields from 1 to 15.5 kG and at temperatures between 2 and 300 K. The system is interfaced to a computer which collects data from the electrobalance and the thermometer, and controls the magnitude of the applied field, the sign of the gradient and the temperature controller. The capabilities of this instrument were crucial to the investigation of brominated (SN), as it permitted a detailed in situ study of the effects of bromine concentration. A strong linear dependence of the susceptibility on both bromine concentration and temperature was found. Dissert. Abstr.

N81-26964*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.
STRESS GENERATION IN THERMALLY GROWN OXIDE FILMS Final Report
Albert J. Kumnick and Lynn J. Ebert 7 Jul. 1981 77 p refs (Grant NAG3-49)
(NASA-CR-164520) Avail: NTIS HC A05/MF A01 CSCL 20I

A three dimensional finite element analysis was conducted, using the ANSYS computer program, of the stress state in a thin oxide film thermally formed on a rectangular piece of NiCrAl alloy. The analytical results indicate a very high compressive stress in the lateral directions of the film (approximately 6200 MPa), and tensile stresses in the metal substrate that ranged from essentially zero to about 55 MPa. It was found further that the intensity of the analytically determined average stresses could be approximated reasonably well by the modification of an equation developed previously by Oxx for stresses induced into bodies by thermal gradients. Author

N81-26965# University of Southern California, Los Angeles. Electronic Sciences Lab.
EVALUATION OF GALLIUM NITRIDE FOR ACTIVE MICROWAVE DEVICES Final Report, 1 Jan. 1975 - 30 Sep. 1980
M. Gershenzon May 1981 83 p refs
(Contract N00014-75-C-0295; NR Proj. 243-004; RR0210203)
(AD-A099344) Avail: NTIS HC A05/MF A01 CSCL 09/5

The predicted figure of merit for GaN as a transit-time limited microwave power amplifier material is significantly greater than that of Si or GaAs because of the small electron mass, the large optical phonon energies and the large bandgap of GaN. To confirm these predictions by measuring the saturated drift velocity and the pair-production thresholds, it was necessary to prepare uncompensated n-type single crystals with carrier densities below about 10 to the 17th power/cc. Because the melting point of GaN is extremely high, + 2,000C, with a corresponding equilibrium N2 pressure of + 40,000 atm, it was necessary to use a chemical vapor deposition method (wherein GaCl was allowed to react with NH3, a more active source of N than N2 and kinetically stable with respect to N2 at temperatures below 1100C) to grow single crystal GaN epitaxially on sapphire substrates. However, their surface morphology was non-planar, and they displayed Ga occlusions, microcracks and voids, the latter two appearing only in the thicker layers. Very slow growth eliminated all these problems except the non-planarity. Epitaxial growth of planar, crystallographically sound crystals was finally achieved on basal plane substrates. All the crystals grown were n-type with carrier densities of 10 to the 18th to the 20th power/cc. These observed densities were more or less independent of all crystal growth parameters, including replacing the Ga halide reactant source with a Ga organometal source. GRA

N81-26966# Brown Univ., Providence, R. I. Dept. of Chemistry.
PREPARATION AND PROPERTIES OF THE SYSTEM Fe(1-X)V(X)NbO4
B. Khazai, R. Kershaw, K. Dwight, and A. Wold 15 May 1981 23 p refs Submitted for publication
(Contract N00014-77-C-0387; NR Proj. 359-653)
(AD-A099212; TR-16) Avail: NTIS HC A02/MF A01 CSCL 20/12

Members of the system Fe(1-x)V(x)NbO4 were prepared and their crystallographic, electrical, and magnetic properties were determined. The wolframite structure is formed for x less than or equal to 0.2, but for x greater than or equal to 0.4, a phase transformation to the rutile structure takes place. Magnetic studies established the formal valencies of the elements for members crystallizing with the wolframite phase. However, similar analyses of compounds with the rutile structure did not provide a unique assignment of the formal valencies. Author (GRA)

N81-26967# Science Applications, Inc., La Jolla, Calif.
FURTHER STUDIES ON NONLINEAR ADAPTIVE OPTICS
A. Elci, J. Nagel, and D. Rogovin Apr. 1981 95 p refs
(Contract F49620-79-C-0027)
(AD-A099167; AFOSR-81-0464TR) Avail: NTIS HC A05/MF A01 CSCL 20/6

This work examines interband transitions near the bandedge, alkali type ious embedded in dielectrics, and two-photon resonances in three-level systems for the purpose of four-wave mixing and phase conjugation at the iodine laser frequency. It also examines the time-dependent properties of unstable resonators with a saturable gain medium. The third order susceptibility and the conjugate reflectively of semiconductors are calculated. Near the band edge the reflectivity is enhanced. The unstable-resonator field is represented in terms of a series of empty resonator modes, and a set of first order in time differential equations for the expansion coefficients is achieved. There is a stable solution and a bistable one, with self-sustaining pulsations. Author (GRA)

N81-26968# Spectrolab, Inc., Sylmar, Calif.
LOW RESISTIVITY: HIGH LIFETIME SINGLE CRYSTAL SILICON INVESTIGATION Final Report, Aug. 1977 - Dec. 1980
J. Fodor and R. W. Opjorden Wright-Patterson AFB, Ohio AFWAL Mar. 1981 48 p refs
(Contract F33615-77-C-2045; AF Proj. 2308)
(AD-A099272; AFWAL-TR-81-2013) Avail: NTIS HC A03/MF A01 CSCL 20/12

Results of recent studies at Spectrolab utilizing improved quality, low resistivity silicon material are presented. Crystal doping methods used include boron ion implantation, diborane gas, and elemental gallium doping. Nt/P solar cells were fabricated from these materials and then evaluated electrically, both beginning of life and after electron irradiation. Cells made from 0.17 ohm-cm Si:Ga material yielded the most impressive results, with open circuit voltages of 633 mV at 25C, AMO. This float zone grown material also proved stable under photon irradiation post electron irradiation. Author (GRA)

N81-26969# Leiden Univ. (Netherlands).
ON THE COOPERATIVE JAHN-TELLER EFFECT IN TERNARY CHROMIUM (2) AND COPPER (2) HALIDES
Willem Jacobus Crama 1980 159 p refs
(INIS-MF-5987) Avail: NTIS (US Sales Only) HC A08/MF A01; DOE Depository Libraries

The hexagonal perovskite structure next to some cubic perovskite and related structures was examined. Structure determinations are performed on (BETA), (-)-CsCrCl3, (BETA), (ALPHA)-RbCrCl3, (BETA), (ALPHA)-RbCuCl3, (ALPHA), (-)-CsCuCl3 and Rb3Cu2Cl7. DOE

N81-26970# Illinois Univ., Urbana. Dept. of Physics.
CORRELATED BCS THEORY
S. Fantoni 1981 6 p refs Presented at the 2nd Intern. Conf. on Recent Progress in Many Body Theories, Morelos, Mex., 1981
(Contract DE-AC02-76ER-01198)
(DOE/ER-01198/1341; CONF-810107-4) Avail: NTIS HC A02/MF A01

A variational theory of the BCS pair-condensed state of strongly-interacting Fermi system is briefly outlined. An FHNC scheme is devised to calculate the radial distribution function and the one and the two body density matrices. DOE

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N81-26971# Army Cold Regions Test Center, Fort Greely, Ark.
INTRODUCTION TO THE BASIC THERMODYNAMICS OF COLD CAPILLARY SYSTEMS
Samuel C. Colbeck Mar. 1981 14 p refs
(DA Proj. 4A1-61102-AT-24)
(AD-A099138; CRREL-SR-81-6) Avail: NTIS HC A02/MF A01 CSCL 20/13

The basic principles of phase equilibrium thermodynamics are reviewed. These principles are used to derive several useful relations such as osmotic pressure and Kelvin's equation. Several examples are given of the application of thermodynamics to cold regions materials such as grain growth in wet snow and capillary condensation in rocks. Author (GRA)

N81-26972# Washington Univ., Seattle. Dept. of Physics.
PERTURBATIVE QCD AT FINITE TEMPERATURE AND DENSITY: A BRIEF TECHNICAL REVIEW
L. McLerran Dec. 1980 16 p refs Presented at the Intern. Symp. on Statist. Mech. of Quarks and Hadrons, Bielefeld, West Germany, 24 Aug. 1980
(Contract DE-AC06-76ER-01388)
(RLO-1388-840; CONF-800895-1) Avail: NTIS HC A02/MF A01

The methods and results of perturbative calculations of the thermodynamic parameters that characterize a finite temperature and density quark gluon gas are reviewed. The problems which arise in such calculations are outlined DOE

N81-26973# Massachusetts Inst. of Tech., Cambridge. Center for Theoretical Physics.
QUANTUM MEAN-FIELD THEORY OF COLLECTIVE DYNAMICS AND TUNNELING
J. W. Negele Jan. 1981 10 p refs Presented at the 2nd Intern. Conf. on Recent Progress in Many-Body Theories, Mexico City, 12-16 Jan. 1981 Submitted for publication
(Contract DE-AC02-76ER-03069)
(CONF-810107-3) Avail: NTIS HC A02/MF A01

Significant progress was made recently in formulating the quantum many body problem in terms of an expansion about solutions to time dependent mean-field equations. The essential ideas, principal resutls, and illustrative examples are summarized. An exact expression for an observable of interest is written using a functional integral representation for the evolution operator, and tractable time dependent mean field equations are obtained by application of the stationary phase approximation to the functional intergral. Corrections to the lowest order theory may be systematically enumerated. DOE

N81-26974# National Bureau of Standards, Washington, D.C. National Engineering Lab.
THE THERMODYNAMIC PROPERTIES HELIUM-2 FROM 0 K TO THE LAMBDA TRANSITIONS
Robert D. McCarty Dec. 1980 64 p refs
(PB81-161895; NBS-TN-1029) Avail: NTIS HC A04/MF A01 CSCL 20H

The equation of state of He-2 is modeled by an equation of state explicit in pressure as a function of density and temperature. The equation of state is divided into three regions of temperature 0 to .8 K, .8 to 1j2 to the lambda temperature for which similar functional forms are used with different adjustable parameters. The combined functions are valid over the entire PT range of the superfluid and may be used for all classical thermodynaic properties. Comparisons between calculated and experimental data are presented. A computer program for calculation of thermodynamic properties (PVT, isochoric heat capacity, isobaric heat capacity, internal energy, enthalpy, entropy, and velocity of sound) is included GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N81-26975# Mitre Corp., Bedford, Mass.
SEEK TALK FULL SCALE ENGINEERING DEVELOPMENT LIFE CYCLE COST (LCC) MODEL. VOLUME 1: LCC MANAGEMENT
Robert V. D. Campbell Hanscom AFB, Mass. Deputy for Communications and Information Systems Apr. 1981 24 p
(Contract F19628-81-C-0001)
(AD-A098976; MTR-8210-Vol-1; ESD-TR-81-122-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 05/1

This document is a manual for the application of the computerized Life Cycle Cost (LCC) Model designed for the Full-Scale Engineering Development (FSED) Phase of the SEEK TALK Program. FSED contractors will use the model to perform cost estimates, identify cost drivers and make trade and other cost related analyses. The manual assists users in establishing input parameter values, making LCC calculations and utilizing results. It also describes how to prepare computer inputs and run the model in either the interactive or batch mode. Volume 1 is entitled Life Cycle Cost Management, and Volume 2, Model Equations and Model Operations. GRA

N81-26976# Office of Management and Budget, Washington, D. C.
INFORMATION COLLECTION BUDGET OF THE UNITED STATES GOVERNMENT, FISCAL YEAR 1981
1981 94 p
(PB81-152357) Avail: NTIS HC A05/MF A01 CSCL 05A

Paperwork and red tape were studied for 2 years by the commission on federal paperwork. The commission recommended that the Federal government manage reporting and related information functions as a resource, like other resources used in operating Federal programs resulting in the information collection budget (ICB). Agencies that impose over 95% of executive branch paperwork on the public are required to prepare comprehensive proposals in the form of a budget for all such reporting in the upcoming fiscal year. The budget is expressed in the amount of the public's time that agencies propose to require to fill out reports and keep records. An allowance was approved for each agency of the total amount of reporting and recordkeeping burden. GRA

N81-26977# Michigan State Legislature, Lansing.
SCIENCE AND THE LEGISLATIVE PROCESS (A REPORT SUBMITTED TO JOINT COMMITTEE ON SCIENCE AND TECHNOLOGY, SCR 246)
Richard L. McAnaw 1980 96 p refs
(Grant NSF ISP-77-25882)
(PB81-158495; NSF/RA-800352) Avail: NTIS HC A05/MF A01 CSCL 05A

An investigation to determine whether an improved science information mechanism is needed by the Michigan Legislature is reported. The study surveyed experiences in other states, assessing current mechanisms for delivering information on Science related issues of public policy. Issues with science components and the sources utilized for obtaining scientific and technological information were evaluated. A proposal emerged which would establish the Legislature Office of Science Advisor (LOSA) to serve the science information needs of the two chambers in a bipartisan manner. LOSA would be under the jurisdiction of a joint committee on science and technology and administered by the Senate Fiscal Agency. GRA

N81-26978# Minnesota State Planning Agency, St. Paul.
IMPROVING SCIENTIFIC AND TECHNICAL RESOURCES UTILIZATION Final Report
1980 32 p
(Grant NSF ISP-78-04615)
(PB81-158909; NSF/RA-800364) Avail: NTIS HC A03/MF A01 CSCL 05A

The question of how to improve the Executive Branch's utilization of scientific and engineering personnel and resources within the context of a case study of a particular problem solving effort was analyzed. A major task involving extensive scientific and engineering components was selected: the Special Study on Hazardous and Solid Waste, authorized by Minnesota's 1978 Legislature. In addition to the case study, efforts were made to identify existing efforts or arrangements employed by any state agency or department of the Executive Branch to improve its use of scientific or engineering knowledge. This task was accomplished through interviews with major department and agency heads by the project management. GRA

N81-26979# Claremont Graduate School, Calif.
EVALUATING THE SCIENTIFIC QUALITY OF APPROPRIATE TECHNOLOGY Final Report
David E. Drew, Kathleen McDonnell, and Patricia Raymond Oct. 1980 67 p refs
(PB81-159741; NSF/RA-800386) Avail: NTIS HC A04/MF A01 CSCL 05A

Given differences between Appropriate Technology (AT) and conventional technology evaluation criteria which should be used to ensure that research and development in AT conform to the highest scientific standards are discussed. Traditional criteria for assessing scientific quality are analyzed. The Appropriate Technology movement and a perspective about assessment of AT is reviewed is suggested. Specific recommendations are made with respect to proposal evaluation, funding strategies, and project assessment. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N81-26980# Illinois Univ. at Chicago Circle, Chicago. Knowledge Systems Lab.

A MODEL FOR INFORMATION EXCHANGE, REVISION

Shi-Kuo Chang 1 Mar. 1981 43 p refs

(Contract N00014-80-C-0651)

(AD-A098967; TR-53) Avail: NTIS HC A03/MF A01 CSCL 05/2

Information exchange theory aims at the study and modeling of information exchange processes among interacting agents. In this paper, we develop a model for information exchange. The concepts of protocols, types of information systems, misinformation and information distortion, modification, and information distance are introduced. Examples of information exchange processes are given. In the appendix, a model for competitive information exchange is presented. The estimation of alien models for this competitive information exchange model is described.

Author (GRA)

N81-26981# California Univ., Livermore. Lawrence Livermore Lab.

COMPUTERIZED SYSTEM FOR DATA HANDLING

W. Boyle, H. Brand, R. Yamauchi, and R. Bystroff 1980 16 p Presented at the 8th Ann. DOE Compatibility Meeting, Los Alamos, N. Mex., 13-16 Oct. 1980 Submitted for publication

(Contract W-7405-eng-48)

(UCRL-84419; CONF-801074-3) Avail: NTIS HC A02/MF A01

An open-ended, menu-directed set of FORTRAN programs was written to produce graphic displays and otherwise process data from a number of different surface science instruments. Programs were written for X-ray photoelectron and Auger spectroscopies. The data produced by these instruments are stored in a Nicolet, Model 1074, hard wired, multi-channel, data analyzer in 1024 channels. These 1024 data points are sent serially to the computer. The operator then enters the sample information and experimental parameters of the spectrum. The spectrum can then be manipulated using a variety of interactive graphic routines. The basic hardware for the system consists of an LSI-11/2, 10 Mbyte disk drive, and a 4027 Tektronix color graphics terminal. DOE

N81-26982# Executive Office of the President, Washington, D.C Office of Administration.

A GUIDE TO PUBLICATIONS OF THE EXECUTIVE OFFICE OF THE PRESIDENT, VOLUME 2, ISSUE 4 Progress Report, Jan. 1980 - Jan. 1981

20 Jan. 1981 17 p

(PB81-168593) Avail: NTIS HC A02/MF A01 CSCL 05B

The policy making aspects of the executive branch of the Federal Government are reviewed. The publications are used by the EOP staff, members of Congress and their staffs, employees of other executive agencies, state and local government officials, researchers, journalists, political scientists, economists, and others interested in the work of the EOP agencies. The quarterly Guide to Publications of the Executive Office of the President has been introduced as a major component of the EOP Publications Management Program. Publications are grouped by sponsoring EOP agency and the source of availability is given for each publication. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N81-26983# California Univ., Livermore. Lawrence Livermore Lab.

ROLE OF FINANCING IN THE MARKETABILITY OF CAPITAL INTENSIVE SOLAR TECHNOLOGIES FOR INDUSTRY

W. C. Dickinson 30 Dec. 1980 10 p refs Presented at 3d Ann. Systems Simulation, Economic Analysis/Solar Heating and Cooling Operational Results Conf., Reno, Nev., 27 Apr. 1981

(Contract W-7405-eng-48)

(UCRL-85327; CONF-810405-11) Avail: NTIS HC A02/MF A01

Three methods of financing large, capital-intensive, industrial solar systems are examined: conventional end-user financing; conventional lease financing; and the solar management company/limited partnership (SMC). The primary disadvantage of the first method is the large capital investment required of the end-user. The availability of investment capital is limited and other investment priorities are dominant. In the latter two methods the end-user is not required to provide any front-end capital. The SMC structure is attractive in that the end-user pays only for solar energy delivered to the process and is not required to operate and maintain the system. Certain types of initial government assistance are needed to make this financing technique feasible. DOE

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N81-26984# Water Resources Council, Washington, D.C. Planning Procedures and Plan Utilization Task Force.

IMPROVING THE PLANNING AND MANAGEMENT OF THE NATION'S WATER RESOURCES Final Report

2 Jul. 1980 150 p

(PB81-162059) Avail: NTIS HC A07/MF A01 CSCL 13B

Under provisions of the Water Resources Planning Act of 1965, the U.S. Water Resources Council was assigned responsibilities for guiding, coordinating, and improving the processes of planning for water and related land resources. Procedural issues and problems which exist in the planning process are summarized. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N81-26985 Kansas Univ., Lawrence.

TRANSPORTATION INVESTMENT STRATEGY: A KEY ELEMENT IN THE LONG RANGE MACRO TRANSPORTATION PLANNING FOR A DEVELOPING COUNTRY Ph.D. Thesis

Ali Mansourkhaki 1980 258 p

Avail: Univ. Microfilms Order No. 8111789

The trends of transportation investment and economic development of the United States for the past 32 years, Canada for the past 30 years, England for the past 26 years, and Japan for the past 23 years were investigated. The Gross National Product, the Industrial Index, and the Total Investment of these selected countries were considered as indicators of economic development. Transportation variables such as facilities for all modes of transportation, all modes of transportation, all modes of transportation activities, and total transportation investment on the development of all modes of transportation were considered as indicators of the transportation system. The mathematical models of transportation investment versus economic development

of the selected countries were prepared by using a multiple-regression technique. Dissert. Abstr.

N81-26986*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF VOLTAGE ON THE COST OF AN ELECTRIC VEHICLE PROPULSION SYSTEM
Richard M. Schuh and Edward F. McBrien 1981 31 p refs Proposed for presentation at the 91st Natl. Meeting of the Am. Inst. of Chem. Engrs., Detroit, 16-19 Aug. 1981
(Contract DE-AI01-77CS-51044)
(NASA-TM-82592; DOE/NASA/51044-20; E-839) Avail: NTIS HC A03/MF A01 CSCL 13F

The life cycle cost and the purchase price of simple dc and ac propulsion systems are estimated as a function of battery voltage from 50 to 500 V. The results show a slight preference for a battery pack voltage of approximately 100 V. Three propulsion systems are examined: one has a series motor with a chopper controller, another an induction motor with an inverter controller, and the third a shunt motor using stepped-voltage control below base speed and field control above base speed. Motor power rating is assumed to be 20 kW continuous duty. The cost and the specific energy of a 24 kW-hr battery pack are estimated from 50 to 500 V by a battery manufacturer. The impact of system voltage variation on the efficiency, weight, and cost of the other electrical components is estimated from basic electrical considerations and informal discussions with manufacturers. Author

N81-26987# Harvard Univ., Boston, Mass. Graduate School of Business Administration.
THE TRANSFER OF TECHNOLOGY BY MULTINATIONAL ENTERPRISES: A SUMMARY OF THREE STUDIES Final Report
Robert B. Stobaugh and Piero Telesio (Tufts Univ.) Sep. 1980 116 p refs
(Grant NSF PRA-74-19491)
(PB81-158172; NSF/PRA-7419491/1) Avail: NTIS HC A06/MF A01 CSCL 05A

The transfer of manufacturing technology through licensing, the choice of technology in investments in developing countries, and the development of a computer model to optimize foreign investment location and intercompany trade decisions are assessed. The reasons why multinational enterprises license abroad, licensing to supplementary foreign investment, and licensing for reciprocity are analyzed. Two industries, textile and pulp and paper, were selected for study. Research methodology, including alternative technologies and procedures used to determine choices, is discussed. A model of international investment planning, presenting both company and government points of view is presented. GRA

N81-26988# Harvard Univ., Boston, Mass. Graduate School of Business Administration.
THE TRANSFER OF TECHNOLOGY BY MULTINATIONAL ENTERPRISES: A SUMMARY OF THREE STUDIES
Robert B. Stobaugh and Piero Telesio (Tufts Univ.) Sep. 1980 19 p ref
(Grant NSF PRA-74-19491)
(PB81-159477; NSF/PRA-7419491/2) Avail: NTIS HC A02/MF A01 CSCL 05A

The studies concentrated on the transfer of manufacturing technology through licensing; and the choice of technology in investments in developing countries. The development of a computer model to optimize foreign investment location and intercompany trade decisions is summarized. GRA

N81-26989# Copenhagen Univ. (Denmark).
SCIENCE, TECHNOLOGY AND DEVELOPMENT
Bent Sorensen Jul. 1980 28 p refs Presented at 3d Intern. Symp. of Eng., 25-30 Jul. 1980; sponsored by Universiad Centroamerica
(PB81-161994) Avail: NTIS HC A03/MF A01 CSCL 05A

General relations between science, technology and development are described. Aspects covered include: development goals, the conservation of cultural traditions, the application of science and technology connected with sustaining militarism and oppression, the appropriate choice of technology, the role of the United Nations on improving information channels in the developing countries and on formulating independent technology policies and the social framework of development. It is concluded that any attempt to discuss the role of science and technology for development without dealing with the democratic implications is bound to be incomplete or even misleading. GRA

N81-26990# Hawaii Univ., Honolulu.
HAWAII SCIENCE, ENGINEERING AND TECHNOLOGY PROJECT
May 1980 163 p refs
(Grant NSF ISP-78-02514)
(PB81-163321; NSF/RA-800350) Avail: NTIS HC A08/MF A01 CSCL 05A

A system was designed to facilitate the exchange of information between Hawaii state legislators and professional scientists, engineers, and technologists in the community. Nine alternatives were designed as possible science, engineering, and technology (SET) Mechanisms for the Hawaii State Legislature. Based on the information obtained from the interviews with legislators and the in-house legislative service agency staff and the survey of SET organizations, eleven relevant criteria were developed under three major areas of concern: content, process, and feasibility. Each alternative was assessed in terms of the eleven criteria. GRA

N81-26991# General Accounting Office, Washington, D. C. Federal Personnel and Compensation Div.
MAKING PUBLIC BUILDINGS ACCESSIBLE TO THE HANDICAPPED: MORE CAN BE DONE Report to the Congress
6 Jun. 1980 60 p
(PB81-160806; FPCS-80-51) Avail: NTIS HC A04/MF A01 CSCL 13M

The Architectural Barriers Act of 1968 requires federally funded buildings to be accessible to handicapped persons. To oversee the actions of Federal agencies and insure that buildings are barrier free, the Architectural and Transportation Barriers Compliance Board was established by the 1973 Rehabilitation Act. Confusion exists among the Compliance Board and other agencies because of overlapping legal mandates and no clear definition of oversight and leadership roles. As a result, the Compliance Board has not been able to provide the leadership necessary to oversee agency actions in eliminating barriers for the handicapped. Recommendations are made to resolve these and other issues. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-26992 Cornell Univ., Ithaca, N. Y.
NEUTRAL HYDROGEN 21CM LINE EMISSION: ABSORPTION OBSERVATIONS OF THE INTERSTELLAR MEDIUM Ph.D. Thesis
Harry Edward Payne 1981 185 p
Avail: Univ. Microfilms Order No. 8110886

Data indicate that the gas is not generally clumped into cloudlets, and therefore that measured spin temperatures are reliable. In particular, apparent variations in the temperature of the absorbing gas are real. The data reveal no dependence of spin temperature on galactic latitude except that the fluctuations in temperature are larger at high latitudes where the total column density is small. The cold absorbing gas makes up a relatively constant 60 percent of the total column density. The closest correlation between observed quantities is that between spin

temperature and optical depth for high latitude absorption features. Deviations from this correlation may indicate the presence of rare small clouds. Dissert. Abstr.

N81-26993 Cornell Univ., Ithaca, N. Y.
FAR-INFRARED FINE-STRUCTURE LINE STUDIES OF GALACTIC NEBULAE Ph.D. Thesis
Gary Joel Melnick 1981 161 p
Avail: Univ. Microfilms Order No. 8110882

A two channel liquid helium cooled grating spectrometer was used to observe fine structure line emission from a variety of galactic nebulae. The [OI] 63.2 micrometer line was detected from two galactic HII regions, M42 and M17, and the planetary nebula NGC7027. Using the strength of the 6300 A [OI] line, estimates were made of the temperature of the [OI] emitting region in M42. Two possible models to produce the observed 63.2 micrometers flux from NGC7027 are considered. The first involves shocks; the second the heating of the gas by near ultraviolet radiation. Dissert. Abstr.

N81-26994 Indiana Univ., Bloomington.
THE DEVELOPMENT OF A DIFFERENTIAL CAMERA Ph.D. Thesis
Dennis George Socker 1981 155 p
Avail: Univ. Microfilms Order No. 8112470

The differential camera operates as follows. For each emission line observed, two nearly simultaneous narrow bandpass filter images are obtained. The bandpass of one image is centered on the emission line of interest and the bandpass of the other image is centered on the adjacent continuum. A difference image is derived by subtracting the continuum image from the on-line image. In the differencing process, the emission line signal remains virtually constant while the stellar, night sky and airglow continuum background are strongly suppressed. The resulting images are well suited to the measurement of emission line strengths. Laboratory and telescope tests of the camera are presented. The tests show it is capable of measuring faint emission line signals and suppressing stellar features by a factor of about ten. Dissert. Abstr.

N81-26995*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
S201 CATALOG OF FAR-ULTRAVIOLET OBJECTS
Thornton Page, George R. Carruthers, and Harry M. Heckathorn [1981] 151 p refs Prepared in cooperation with NRL, Washington, D.C.
(NASA-TM-82376; NRL-8173) Avail: NTIS HC A08/MF A01 CSCL 03A

The results of analysis of the images of stars and other discrete objects obtained from the lunar based far ultraviolet camera/spectrograph (experiment S201) are presented. The brightnesses of all objects are placed on an absolute scale of UV magnitudes based on instrument preflight calibrations. These magnitudes are compared with expectations based on stellar model atmosphere flux distributions, and with those obtained from calibrated OAO-2 observations. The data reduction programs are also described. M.G.

N81-26996*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DISTRIBUTION OF HOT STARS AND HYDROGEN IN THE LARGE MAGELLANIC CLOUD
Thornton Page and George R. Carruthers (Naval Research Lab., Washington, D.C.) 1981 52 p refs
(Contract NAS5-25481)
(NASA-TM-82375) Avail: NTIS HC A04/MF A01 CSCL 03A

Imagery of the Large Magellanic Cloud (LMC), in the wavelength ranges 1050 to 1600 A and 1250 to 1600 A, was obtained by the S201 far ultraviolet camera during the Apollo 16 mission. These images were reduced to absolute far-UV intensity distributions over the area of the LMC, with 3 to 5 arc min angular resolution. Comparison of these far-UV measurements in the LMC with H sub alpha and 21 cm surveys reveals that interstellar hydrogen in the LMC is often concentrated in 100 pc clouds within 500 pc clouds. Furthermore, at least 25 associations of O-B stars in the LMC are outside the interstellar hydrogen clouds; four of them appear to be on the far side. Far-UV and mid-UV spectra were obtained of stars in 12 of these associations, using the International Ultraviolet Explorer. Equivalent widths of L alpha and six other lines, and relative intensities of the continuum at seven wavelength from 1300 A to 2900 A, were measured. These spectra are also discussed. M.G.

N81-26997*# Dynatrend, Inc., Burlington, Mass.
REPORT OF THE FACILITY DEFINITION TEAM SPACELAB UV-OPTICAL TELESCOPE FACILITY
Dec. 1975 109 p Original contains color illustrations
(Contract NAS5-20936)
(NASA-CR-166665) Avail: NTIS HC A06/MF A01 CSCL 03A

Scientific requirements for the Spacelab Ultraviolet-Optical Telescope (SUOT) facility are presented. Specific programs involving high angular resolution imagery over wide fields, far ultraviolet spectroscopy, precisely calibrated spectrophotometry and spectropolarimetry over a wide wavelength range, and planetary studies, including high resolution synoptic imagery, are recommended. Specifications for the mounting configuration, instruments for the mounting configuration, instrument mounting system, optical parameters, and the pointing and stabilization system are presented. Concepts for the focal plane instruments are defined. The functional requirements of the direct imaging camera, far ultraviolet spectrograph, and the precisely calibrated spectrophotometer are detailed, and the planetary camera concept is outlined. Operational concepts described in detail are: the makeup and functions of shuttle payload crew, extravehicular activity requirements, telescope control and data management, payload operations control room, orbital constraints, and orbital interfaces (stabilization, maneuvering requirements and attitude control, contamination, utilities, and payload weight considerations). J.D.H.

N81-26998*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PKS 2155-304 RELATIVISTICALLY BEAMED SYNCHROTRON RADIATION FROM BL LAC OBJECT
Claudia Megan Urry and Richard F. Mushotzky Mar. 1981 32 p refs Submitted for publication
(NASA-TM-82101) Avail: NTIS HC A03/MF A01 CSCL 03A

The newly discovered BL Lacertae object, PKS 2155-304, was observed with the medium and high intensity energy detectors of the HEAO-1 A2 experiment. The variability by a factor of two in less than a day reported by Snyder, et al (1979) is confirmed. Two spectra, obtained a year apart, while the satellite was in scanning mode, are well fit by simple power laws with energy spectral index alpha sub 1 equals approximately 1.4. A third spectrum, of higher statistical quality, obtained while the satellite was pointed at its source, has has two components. An acceptable fit was obtained using a two power law model, with indices alpha sub 1 equals 2.0 (+1.2, -0.6) and alpha sub 2 equals -1.5 (+1.5, -2.3). An interpretation of the overall spectrum from radio through X-rays in terms of a synchrotron self-Compton model gives a good description of the data if allowance is made for relativistic beaming. Thus, from a consideration of the spectrum, combined with an estimate of the size of the source, the presence of jets is inferred without their observation. A.R.H.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-26999 Massachusetts Univ., Amherst.
THE INTERACTION OF HII REGIONS WITH MOLECULAR CLOUDS Ph.D. Thesis
John Bally 1981 235 p
Avail: Univ. Microfilms Order No. 8110303

The energetics and dynamics of molecular gas associated with HII regions are investigated. The energetics of the molecular cloud boundary layer was probed by CO line observations. In S87, S155 Cepheus B, and S125 the radiation field is to weak and the gas density is too small to heat the cloud edge to the

observed temperature by means of gas dust collisions. A energy input mechanism for the molecular gas is postulated; direct heating of gas by photoelectrons ejected from grains by the intense UV radiation available just outside HII regions. Several of the youngest HII regions are young biconical nebulae whose peculiar morphology reflects the initial conditions in which isolated stars can form. In S106 a ridge of molecular emission is interpreted as a massive disk constraining the development of the HII region. The model of disk constrained HII regions can explain the observed high velocity outflows observed in the ionized gas associated with S106 and explain the hourglass shape of the nebula. In more evolved HII regions, shock waves are seen as doppler shifted spectral line components whose location correlates well with the distribution of high electron density plasma.

Dissert. Abstr.

N81-27000 Wyoming Univ., Laramie.

THE SPATIAL DISTRIBUTION OF INFRARED EMISSION FROM PLANETARY NEBULAE Ph.D. Thesis

Alan Frank Bentley 1980 117 p

Avail: Univ. Microfilms Order No. 8111596

Infrared observations of NGC 7027 and BD + 30 degrees 3639 were made with the Wyoming 2.3 meter telescope during the period 4 May to 1 December 1979. Spatial maps centered on the nebulae were obtained. The spatial distribution of the IR emission in each band was compared to the emission from ionized hydrogen as represented by 5 GHz radio emission for NGC 7027, and by H beta emission for BD + 30 degrees 3639. Spatial regions outside the main IR nebula were searched for significant emission in all spectral regions studied at approximately the 1 percent level, with negative results. The 10 micrometers spectral region in NGC 7027 was shown to contain two distinct components of dust, on the basis of spatial distribution in the nebula. Both the H beta and IR data for BD + 30 degrees 3639 indicate that it is a hollow shell structure. Dissert. Abstr.

N81-27001 Boston Univ., Mass.

A HYDRODYNAMICAL SIMULATION OF THE CORE HELIUM FLASH WITH TWO-DIMENSIONAL CONVECTION Ph.D. Thesis

Peter William Cole 1981 160 p

Avail: Univ. Microfilms Order No. 8112190

The thermonuclear runaway of helium reactions under the condition of electron degeneracy in the hot, dense central regions of a low mass Population 2 red giant was investigated. A two dimensional finite difference approach to time dependent convection was applied to a peak energy production model of this phenomenon called the core helium flash. The initial phase of this hydrodynamical simulation is characterized by a thermal readjustment via downward convective energy transport into the neutrino cooled core in a series of convection modulated thermal pulses. This phenomenon is in marked contrast to the results of previous investigators who employed much more simplistic treatments of convection. After this initial thermal restructuring, there ensues in the simulation a dynamic phase in which the thermonuclear runaway becomes violent. The degree of violence, the final composition, and the peak temperature depend sensitively on the nuclear energy generation rates of those reactions involving alpha particle captures. Even under the most violent conditions the expansion velocities in the core remain substantially less than both the escape velocity and the local sound speed.

Dissert. Abstr.

N81-27002 California Univ., Los Angeles.

SUPERCRITICAL ACCRETION AND THE EDDINGTON LIMIT Ph.D. Thesis

Harry Louis Burger 1980 149 p

Avail: Univ. Microfilms Order No. 8111216

The gas dynamic equations and radiative transfer equations, accurate to the first order in the gas velocity divided by the speed of light, are solved simultaneously for an accreting gas consisting of pure, ionized hydrogen. Free-free, bound-free, and Comptom processes are included in calculating the rate of energy exchange between the gas and radiation field. Supercritical is characterized by a large pulse of radiation with a peak luminosity between 1.3 and 10 times the Eddington luminosity, depending on the initial velocity distribution, which moves out from the neutron star, greatly reducing the initial accretion rate to a critical rate at which the Eddington luminosity is produced. An extended envelope forms around the neutron star in a few milliseconds, in which gravitational potential energy is locally converted into radiant energy, which then diffuses out of the flow. As a result, the emergent luminosity is generated over a wide range of radial distances, rather than in a thin layer near the neutron star surface, as in subcritical flows. Dissert. Abstr.

N81-27003 Boston Univ., Mass.

GAS IN THE GALACTIC HALO Ph.D. Thesis

Antoinette Songaila Cowie 1981 176 p

Avail: Univ. Microfilms Order No. 8112193

Results are reported of an investigation into the existence and structure of a gaseous halo around our own and nearby galaxies. Knowledge of the halo answers questions with regard to the dynamics and energy balance of the gaseous disk and its interchange processes with its surroundings, the structure of the intergalactic medium, the distribution of mass within the galaxy, and the possible halo origin of the quasar absorption lines. Investigations of narrow Ca II and Na I components in the spectra of eleven LMC and SMC supergiant stars, four globular cluster cores, three seyfert galaxy cores and the quasar 3C273, detected a number of components at intermediate velocities between galactic disk material and material at the velocities of the target objects. The number of components is calculated to be 1/3 to 1 per 100 kpc, depending on whether or not the lines of sight to individual stars within the Magellanic Clouds are considered to be independent. This appears to be consistent with the halo absorption interpretation of the origin of high column density quasar absorption line systems. Dissert. Abstr.

N81-27004 Yale Univ., New Haven, Conn.

CLOUD-CLOUD COLLISIONS IN THE INTERSTELLAR MEDIUM Ph.D. Thesis

James Alastair Smith 1980 159 p

Avail: Univ. Microfilms Order No. 8110543

The ramifications of cloud-cloud collisions were examined by one dimensional, time-dependent numerical simulations which include the effects of molecule formation and destruction, line radiation, thermal conductivity, and self gravity. Numerical simulations were computed for interstellar clouds with widely varying initial conditions. Cloud-cloud collisions fall into two classes depending upon whether the clouds are originally atomic or molecular. A collision between standard atomic clouds usually results in the formation of a diffuse molecular cloud, while a collision between molecular clouds is nearly isothermal. The fact that a collision between atomic clouds forms a diffuse molecular cloud tends to support the hypothesis of cloud agglomeration. However, the frequency of cloud-cloud collisions is such that random cloud-cloud collisions cannot be responsible for the formation of giant molecular clouds. Dissert. Abstr.

N81-27005 Cornell Univ., Ithaca, N. Y.

ONE MILLIMETER CONTINUUM OBSERVATIONS OF EXTRAGALACTIC THERMAL SOURCES Ph.D. Thesis

Thomas Leonard Roellig 1981 168 p

Avail: Univ. Microfilms Order No. 8110887

A composite bolometer detector system operating at 0.37 K was developed for making 1 mm continuum observations using the 5 m Hale telescope on Mount Palomar. There seems to be no correlation between the 1 mm flux and the total HI emission from the galaxies. There is perhaps a correlation between the level of synchrotron emission and the 1 mm flux from the galaxies. The 1 mm flux from three points along the galactic plane of M 82 was measured. Only emission from the nucleus was detected, indicating that the dust distribution is strongly peaked at the location of the nucleus. This sharp peak is also seen in CO.

Dissert. Abstr.

N81-27006*# *National Aeronautics and Space Administration.* Marshall Space Flight Center, Huntsville, Ala.

CUSP REGION PARTICLE PRECIPITATION AND ION CONVECTION FOR NORTHWARD INTERPLANETARY MAGNETIC FIELD

J. L. Burch (Southwest Research Inst., San Antonio, Texas), P.H. Reiff (Rice Univ.), R.W. Spiro (Rice Univ.), R. A. Heelis (Texas Univ. at Dallas, Richardson), and S. A. Fields [1981] 12 p *refs*

(Contract NGR-44-004-120)
(NASA-TM-80763) Avail: NTIS HC A02/MF A01 CSCL 03B

Data from Atmosphere Explorer D for periods of strong northward interplanetary magnetic field are discussed. In the dayside magnetospheric cusp region energy time spectrograms of suprathermal positive ion fluxes exhibit a characteristic 'V' pattern as the spacecraft moves toward higher latitudes; that is, with the peak in the energy spectrum falling in energy and then rising again. Convection velocities follow this pattern closely with strong eastwest flows (with antisunward components) occurring in the equatorward half of the 'V' and significant sunward flows occurring in the poleward half of the 'V'. These patterns can be understood qualitatively in terms of a model of ionospheric electric potential produced by the known dependence of Birkeland current densities on magnetic activity. M.G.

N81-27007*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COOLING OF YOUNG NEUTRON STARS AND THE EINSTEIN X-RAY OBSERVATIONS
Kenichi Nomoto and Sachiko Tsuruta (Montana State Univ.) Jun. 1981 21 p refs Submitted for publication
(NASA-TM-82145) Avail: NTIS HC A02/MF A01 CSCL 03B

Cooling of neutron stars is calculated using an exact stellar evolution code. The full general relativistic version of the stellar structure equations are solved, with the best physical input available. For neutron stars with a stiff equation of state, it is found that the deviation from the isothermality in the interior is significant and that it takes at least a few thousand years to reach the isothermal state. By comparing theoretical and observational results, it is concluded that for Cas A, SN1006, and probably Tycho, standard cooling is inconsistent with the results from the Einstein Observatory, if neutron stars are assumed to be present in these objects. On the other hand, the detection points for RCW103 and the Crab are consistent with these theoretical results. M.G.

N81-27008*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SUN AS A STAR
Stuart D. Jordan, ed. Jul. 1981 559 p refs Sponsored in part by CNRS
(NASA-SP-450; Rept-81F0008; LC-81-600064) Avail: NTIS HC $39.50/MF A01 CSCL 03B

Solar physics was reviewed in the context of the solar atmoshere. The understanding of the solar atmosphere is linked to stellar atmospheric research. Topics covered include: the existence of the chromosphere, the corona, and the solar wind; the interactive complex of convection, differential rotation, magnetic field generation and concentration, and the activity cycle; phenomena such as granulation, supergranulation, the 5 minute oscillation, filigree, faculae, sunspots, spicules, prominences, surges, and the spectacular flares. For individual titles, see N81-27009 through N81-27026.

N81-27009*# Arizona Univ., Tucson. Multiple Mirror Telescope Observatory.
DYNAMICS OF THE SOLAR PHOTOSPHERE
Jacques Maurice Beckers *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 11-64 refs (For primary document see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

Current knowledge of photospheric velocity fields is summarized. A model of the solar atmosphere is described along with the methods used in solar velocity field observations. The inferences drawn from integrated Sun observations, the velocity fields of the quiet Sun, sunspots, and other magnetic structures are discussed. T.M.

N81-27010*# Wuerzburg Univ. (West Germany). Inst. fuer Astronomie und Astrophysik.
PULSATIONS AND OSCILLATIONS
Franz-Ludwig Deubner *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 65-84 refs (For primary document see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

The observations of the oscillations of the solar atmosphere are a powerful diagnostic tool for research into the structure of the atmosphere from inside the convection zone to the upper chromosphere. Interpretations of the global pulsations or oscillations are presented with emphasis on using these observations to study the structure of the interior of the Sun. T.M.

N81-27011*# National Center for Atmospheric Research, Boulder, Colo. High Altitude Observatory.
THE CHROMOSPHERE AND TRANSITION REGION
R. Grant Athay *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 85-133 refs (For primary document see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

An empirical definition of the chromosphere and chromosphere-corona transition region is presented. Various general characteristics of the chromosphere are described and include: radiative equilibrium; spatial and temporal fluctuations; spectral characteristics; and thermodynamic structure. T.M.

N81-27012*# Sacramento Peak Observatory, Sunspot, N. Mex.
THE SOLAR CORONA AND THE SOLAR WIND
Jack B. Zirker *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 135-162 refs (For primary document see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

A stellar corona is an extended atmospheric region that is maintained at a significantly higher temperature than that of the stellar photosphere by nonthermal energy input. The solar corona stands as a prototype for all stellar coronas and is a prime example of a stellar atmosphere in which nonthermal processes predominate. Nonthermal processes are those in which the local flux of energy bears no direct relation to the internal energy of the gas or the quality of the radiation the gas emits and absorbs. Observations of the solar corona and the solar wind were surveyed and are presented. T.M.

N81-27013*# Astronomical Inst., Utrecht (Netherlands).
SOLAR MAGNETIC STRUCTURE AND THE SOLAR ACTIVITY CYCLE REVIEW OF OBSERVATIONAL DATA
Cornelius Zwaan *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 163-179 refs (For primary document see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

Data on solar magnetism that may offer clues for understanding stellar magnetism in general were reviewed. Magnetic phenomena in the photosphere and low chromosphere, where the magnetic structure can be studied in detail, are discussed. Properties of the discrete magnetic elements and their extensions through the chromosphere and transition zone up to the corona are described. The structure and evolution of active regions and other structured aggregates of magnetic elements are considered. T.M.

N81-27014*# Glasgow Univ. (Scotland).
SOLAR FLARE OBSERVATIONS AND THEIR INTERPRETATIONS
John C. Brown, Dean F. Smith (Colorado Univ., Boulder), and Daniel S. Spicer (NRL, Washington, D.C.) *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 181-227 refs (For primary document see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

A solar flare has a characteristic spatial extent of 10,000 to 100,000 km. It develops rapidly, with a characteristic time scale of 100 to 1000 s but its manifestations can be observed for hours after onset. A solar flare is the source of highly energetic particles with energies that extend into the GeV range; it produces copious amounts of electromagnetic radiation from gamma-rays to wavelengths of 10 km; and it produces violent magnetohydrodynamic phenomena such as shocks and fast mass ejections. The three basic phases of a flare are described and are: the precursor (preflare) phase, lasting for minutes to hours; the flash phase, lasting for 1 to 5 minutes; and the main (gradual) phase, lasting, on occasion, for hours. T.M.

N81-27015*# National Center for Atmospheric Research, Boulder, Colo. High Altitude Observatory.

GLOBAL CIRCULATION AND THE SOLAR DYNAMO
Peter A. Gilman *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 231-252 refs (For primary document *see N81-27008 17-90*)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

The Sun is apparently rather typical of stars in its spectral *class, with a convection zone of substantial depth and a* modest rotation rate. These two factors are apparently enough to generate a substantial global circulation, seen so far principally *as a differental rotation, as well as a nearly cyclic magnetohydrody-*namic dynamo, seen principally as the 22 year 'solar cycle'. It would be expected therefore that many stars would have such *dynamical characteristics. Recent observations of very large scale* velocity fields of small velocity amplitude were reviewed. T.M.

N81-27016*# Imperial Coll. of Science and Technology, London (England). Dept. of Mathematics.
PENETRATIVE CONVECTION
Daniel R. Moore *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 253-262 refs (For primary document *see N81-27008 17-90*)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

The current state of understanding of the most directly *observable solar convection, the granulation and supergranulation* is summarized. The body of work in which the complete time dependent Navier-Stokes equations and entropy transport equation *are solved for a fully compressible atmosphere is considered.* Relevant anelastic and incompressible calculations in two dimensions are also discussed. T.M.

N81-27017*# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Astronomy Group.
OSCILLATIONS AND PULSATIONS
John W. Leibacher and Robert F. Stein (Michigan State Univ., East Lansing) *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 263-287 refs (For primary document see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

A theory to describe the observed photospheric 5 minute oscillations, chromospheric 3 minute oscillations, and possible motions of the interior with periods ranging from 40 to 160 minutes is discussed. It is similar to the theory of nonradial stellar oscillations developed to describe the low angluar order modes (one or two wavelengths around a circumference); however, the solar oscillations have thousands of wavelengths around a circumference. The properties of waves in stars, their restoring forces, periods and wavelengths, and their propagation and motions are discussed. T.M.

N81-27018*# Michigan State Univ., East Lansing. Dept. of Astronomy and Astrophysics.
WAVE GENERATION
Robert F. Stein and John W. Leibacher (Lockheed Missiles and Space Co., Palo Alto, Calif.) *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 289-300 refs (For primary document see N81-27008 17-90)
(Contracts NASw-3053; NAS5-73758; Grants NsG-7292; NSF AST-79-19465)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

There are three principal kinds of wave generation mechanisms, corresponding to each of the three conservation laws that govern fluid motions: a changing mass flux into a stable *atmosphere; convective motion; and energy exchange between* a wave and the surrounding atmosphere. These mechanisms are *applied to three kinds of waves: acoustic, gravity, and Alfven* waves. They are pure cases, distinguished by their different restoring forces pressure for acoustic waves, buoyancy for gravity waves, and magnetic tension for Alfven waves. T.M.

N81-27019*# National Aeronautics and Space Administration. *Goddard Space Flight Center, Greenbelt, Md.*
CHROMOSPHERIC HEATING
Stuart D. Jordan *In its* The Sun as a Star Jul. 1981 p 301-319 *refs (For primary document see N81-27008 17-90)*
Avail: NTIS HC $39.50/MF A01 CSCL 03B

General features of the solar chromospheric heating problem, *which also apply to many stellar chromospheres, are reviewed.* Current theories are discussed, including: heating by short period sound waves; the weak shock theory; and the time-dependent approach. S.F.

N81-27020*# *Center for Astrophysics, Cambridge, Mass.*
MECHANICAL HEATING IN THE TRANSITION REGION
George Withbroe *In* NASA. Goddard Space Flight Center The *Sun as a Star Jul. 1981 p 321-329 refs (For primary document* see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

Attention is focused on the energy balance in the transition region and the role that mechanical heating plays in determining the temperature density structure of this region in a stellar *atmosphere. Because of its role as the interface layer through* which mass and energy flow between the chromospheres and corona, direct deposition of mechanical energy is a relatively unimportant factor in the overall energy balance in the transition region, except in the uppermost layers where the temperature *approaches coronal values.* S. F.

N81-27021*# Maryland Univ., College Park. Astronomy *Program.*
CORONAL HEATING
Donat G. Wentzel *In* NASA. Goddard Space Flight Center *The Sun as a Star Jul. 1981 p 331-353 refs (For primary* document see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

Theoretical arguments for coronal heating that take into account coronal structure are reviewed. Heating by the dissipation of electrical currents and heating by dissipation of waves *are discussed. Loop structures in the solar corona are de-*scribed. S.F.

N81-27022*# *New Hampshire Univ., Durham. Space Science* Center.
THE ENERGY BALANCE OF THE SOLAR WIND
Joseph V. Hollweg *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 355-372 refs (For primary document see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

The effects of modifying some of the 'classical' assumptions underlying many of the solar wind models constructed over the *past 20 years are examined in an effort to obtain both a better* fit with the observations and a deeper understanding of the relevant physical processes. S.F

N81-27023*# Los Alamos Scientific Lab., N. Mex.
HEATING AND ACCELERATION OF THE SOLAR WIND
Roger A. Kopp *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 373-384 refs (For primary document see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

The dynamics of the expanding corona are discussed emphasizing the physical processes which accelerate the plasma *as it flows away from the Sun. The solar wind plays a dominant* role in the energy balance of the part of the corona in which it originates. The wind acceleration processes, in large part, with *the mechanisms that transport energy to the corona in the first* place. S.F.

N81-27024*# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany).
MAGNETIC FLUX TUBES
Hendrik C. Spruit *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 385-413 refs (For primary *document see N81-27008 17-90)*
Avail: NTIS HC $39.50/MF A01 CSCL 03B

The magnetohydrodynamics of flux tubes are considered. The *sections on equilibrium of flux tubes, and stability and waves* deal with sunspots, the largest members of the general class of photospheric flux tubes. S.F.

N81-27025*# Naval Research Lab., Washington, D. C. Center for Space Research.
SOLAR FLARE THEORY
Daniel S. Spicer and John C. Brown (Glasgow Univ.) *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 *p 413-470 refs (For primary document see N81-27008 17-90)*
Avail: NTIS HC $39.50/MF A01 CSCL 03B

Solar flare models are briefly reviewed with emphasis on the physical mechanisms invoked to explain the flare. The physics of each mechanism and their interrelations are discussed in detail. Mechanisms are classified by their drivers (the source of energy on which they feed). The application of these mechanisms to coronal heating is evaluated. S.F.

N81-27026*# Astronomical Inst., Utrecht (Netherlands).
THE SUN AS A STAR
Robert J. Rutten and Lawrence E. Cram (Sacramento Peak Observatory) *In* NASA. Goddard Space Flight Center The Sun as a Star Jul. 1981 p 473-512 refs (For primary document see N81-27008 17-90)
Avail: NTIS HC $39.50/MF A01 CSCL 03B

The ways in which solar astrophysics serves to improve the methodology for the interpretation of stellar observations and the construction of stellar atmospheric models are summarized. *The astrophysical processes highlighted are: stellar mass; stellar* rotation; stellar magnetism; stellar composition; stellar companions; and evolutionary history. S.F.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-27027 Brown Univ., Providence, R. I.
A COMPARISON OF THE ORIGIN AND EVOLUTION OF A CIRCULAR AND AN IRREGULAR LUNAR MARE
Ph.D. Thesis
James Leslie Whitford-Stark 1980 372 p ref
Avail: Univ. Microfilms Order No. 8111190

Five related studies of the origin and evolution of lunar maria are presented. Photogeologic and remote-sensing studies are summarized as follows: (1) The stratigraphy and eruption styles of basalts within Oceanus Procellarum are outlined. Four major volcanic phases were identified. Oceanus Procellarum is hypothesized to have formed as a large sector graben consequent to the Imbrium basin-forming event. The origin of floor-fractured craters and graben are shown to be related to the thickness of mare fill. The filling of the ancient 900 km diameter, circular Australe basin is described. Four major episodes of basalt eruption ranging in age from early Imbrian to Eratosthenian were recognized. The evolution and basalt fill of the young, multi-ringed Imbrium basin is described. Ten major units, separable in age and chemistry are defined. A comparison of the origin and evolution of a circular and irregular lunar mare is made based on the results described. Dissert. Abstr.

N81-27028*# TRW Systems, Redondo Beach, Calif.
COMETARY PARTICULATE ANALYZER DESIGN DEFINITION STUDY Final Report
N. G. Utterback Jan. 1981 85 p
(Contract NASw-3314)
(NASA-CR-164524; TRW-34645) Avail: NTIS
HC A05/MF A01 CSCL 03B

A concept for remotely determining the relative abundance of elements contained in cometary particulates collected by a spacecraft was conducted with very encouraging results. The technique utilizes a short high intensity burst of laser radiation to vaporize and ionize collected particulate material. Ions extracted from this laser-produced plasma are analyzed in a time of flight mass spectrometer to yield an atomic mass spectrum representative of the relative abundance of elements in the particulates. A prototype analyzer system was designed, constructed, and tested. Results show that: (1) energy-time focus performs as predicted in improving resolution; (2) power densities sufficient to produce usable ionization efficiencies can be obtained; (3) complex alloys such as stainless steel can be analyzed; and (4) a tiny, simple and reliable laser used in the demonstration easily meets spacecraft power and mass limitations. A mass resolution of 150 was experimentally demonstrated at mass 108, and an analytical extrapolation predicts a resolution sufficient to separate masses 250 and 251. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-27029*# Stanford Univ., Calif. Inst. for Plasma Research.
THE COOLING AND CONDENSATION OF FLARE CORONAL PLASMA
S. K. Antiochos and P. A. Sturrock Apr. 1981 24 p refs
(Grant NGL-05-020-272; Contract N00014-75-C-0673)
(NASA-CR-164506; SU-SUIPR-839) Avail: NTIS
HC A02/MF A01 CSCL 03B

A model is investigated for the decay of flare heated coronal loops in which rapid radiative cooling at the loop base creates strong pressure gradients which, in turn, generate large (supersonic) downward flows. The coronal material cools and 'condenses' onto the flare chromosphere. The features which distinguish this model from previous models of flare cooling are: (1) most of the thermal energy of the coronal plasma may be lost by mass motion rather than by conduction or coronal radiation; (2) flare loops are not isobaric during their decay phase, and large downward velocities are present near the footpoints; (3) the differential emission measure q has a strong temperature dependence. S.F.

N81-27030# Stanford Univ., Calif. Inst. for Plasma Research.
AN INTERACTING LOOP MODEL FOR SOLAR FLARE BURSTS
A. Gordon Emslie Mar. 1981 33 p refs
(Contract N00014-75-C-0673; Grant NGL-05-020-272)
(AD-A099222; SU-IPR-831) Avail: NTIS HC A03/MF A01
CSCL 03/2

We show how, as a result of the strong heating produced at chromospheric levels during a solar flare burst, the local gas pressure can transiently attain very large values in certain regions. The effectiveness of the surrounding magnetic field at confining this high pressure plasma is therefore reduced and the flaring loop becomes free to expand laterally. In so doing it may drive magnetic field lines into neighboring, non-flaring, loops in the same active region, causing magnetic reconnection to take place and triggering another flare burst. The features of this interacting loop model are found to be in good agreement with the energetics and time structure of flare-associated solar hard X-ray bursts.
Author (GRA)

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

***N81-27031**#* *Stanford Univ., Calif. Inst. for Plasma Research.*
SYNCHROTRON BRIGHTNESS DISTRIBUTION OF TURBULENT RADIO JETS
R. N. Henriksen, A. H. Bridle (National Radio Astronomy Observatory), and K. L. Chan (Applied Research and Systems)
Jun. 1981 45 p refs
(Grant NGR-05-020-668)
(NASA-CR-164262; SU-SUIPR-844) Avail: NTIS
HC A03/MF A01 CSCL 03B

Radio jets are considered as turbulent mixing regions and it is proposed that the essential small scale viscous dissipation in *these jets is by emission of MHD waves and by their subsequent* strong damping due, at least partly, to gyro-resonant acceleration of supra-thermal particles. A formula relating the synchrotron

surface brightness of a radio jet to the turbulent power input is deduced from physical postulates, and is tested against the data for NGC315 and 3C31 (NGC383). The predicted brightness depends essentially on the collimation behavior of the jet, and, to a lesser extent, on the CH picture of a 'high' nozzle with accelerating flow. The conditions for forming a large scale jet at a high nozzle from a much smaller scale jet are discussed. The effect of entrainment on the prediction is discussed with the use of similarity solutions. Although entrainment is inevitably associated with the turbulent jet, it may or may not be a dominant factor depending on the ambient density profile. A.R.H.

N81-27032*# Stanford Univ., Calif. Inst. for Plasma Research.

RADIO JET REFRACTION IN GALACTIC ATMOSPHERES WITH STATIC PRESSURE GRADIENTS

R. N. Henriksen, J. P. Vallee (Queens Univ., Kingston, Ontario), and A. H. Bridle (National Radio Astronomy Observatory) May 1981 30 p refs

(Grant NGR-05-020-668)

(NASA-CR-164260; SU-SUIPR-845) Avail: NTIS HC A03/MF A01 CSCL 03B

A theory of double radio sources which have a 'Z' or 'S' morphology is proposed, based on the refraction of radio jets in the extended atmosphere of an elliptical galaxy. The model describes a collimated jet of supersonic material bending self-consistently under the influence of external static pressure gradients. Gravity and magnetic fields are neglected in the simplest case except insofar as they determine the static pressure distribution. The calculation is a straightforward extension of a method used to calculate a ram-pressure model for twin radio trails ('C' morphology). It may also be described as a continuous-jet version of a buoyancy model proposed in 1973. The model has the added virtue of invoking a galactic atmosphere similar to those already indicated by X-ray measurements of some other radio galaxies and by models for the collimation of other radio jets. A.R.H.

N81-27033# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

USER REQUIREMENTS OF SOLAR-TERRESTRIAL PREDICTION FOR SPACECRAFT APPLICATIONS Interim Report

Alfred L. Vampola 30 Mar. 1981 27 p refs

(Contract F04701-80-C-0081)

(AD-A099411; TR-0081(6960-05)-4; SD-TR-81-27) Avail: NTIS HC A03/MF A01 CSCL 03/2

This report is a preprint of the Working Group G report from the International Solar-Terrestrial Predictions Workshop held in Boulder, Colorado, in April, 1979. It addresses the current state-of-the-art in predictive capability in three areas of concern to spacecraft applications: the energetic particle environment; the plasma environment; and the neutral atmosphere. Recommendations are made for improvement of predictive capability in these areas. A centralized catalog of predictive techniques and models is also proposed. Author (GRA)

99 GENERAL

N81-27034*# National Aeronautics and Space Administration, Washington, D. C.

THE AEROSPACE SAFETY ADVISORY PANEL'S REPORT TO DOCTOR ROBERT A. FROSCH, 1977

1978 47 p

(NASA-TM-82377) Avail: NTIS HC A03/MF A01 CSCL 05A

Risks attendant to NASA's operations are identified for the following: mission operations; orbiter readiness for orbital flight tests; space shuttle main engine; avionics; thermal projection system; hazard assessment; human error. Past and future projects are assessed. S.F.

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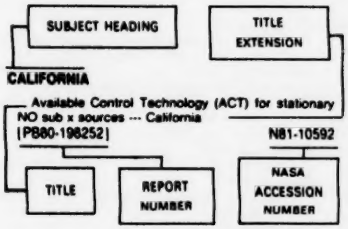

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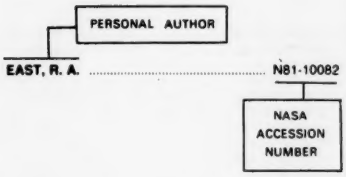

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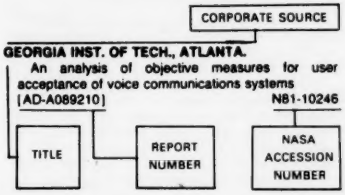

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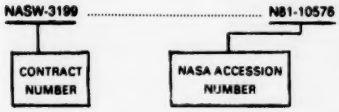

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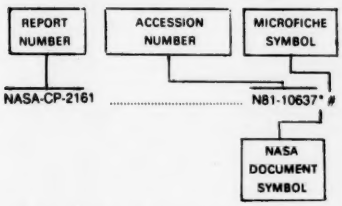

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NASA-CASE-KSC-11042-2 ..... N81-26073* #
NASA-CASE-KSC-11065-1 ..... N81-26359*
NASA-CASE-KSC-11076-1 ..... N81-26402*

NASA-CASE-LAR-12196-1 ..... N81-26358*
NASA-CASE-LAR-12250-1 ..... N81-26161*
NASA-CASE-LAR-12406-1 ..... N81-26114*
NASA-CASE-LAR-12562-1 ..... N81-26152*

NASA-CASE-LEW-12119-2 ..... N81-26447*
NASA-CASE-LEW-12493-2 ..... N81-26179*
NASA-CASE-LEW-13246-1 ..... N81-26203* #

NASA-CASE-MFS-23696-1 ..... N81-26718*

NASA-CASE-NPO-13689-3 ..... N81-26552* #
NASA-CASE-NPO-13689-4 ..... N81-26553* #
NASA-CASE-NPO-14140-1 ..... N81-26509*
NASA-CASE-NPO-14382-1 ..... N81-26509*
NASA-CASE-NPO-15197-1 ..... N81-26697* #

NASA-CP-2186 ..... N81-26372* #
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NASA-CR-3414 ..... N81-26077* #
NASA-CR-3423 ..... N81-26461* #
NASA-CR-3435 ..... N81-26846* #
NASA-CR-3440 ..... N81-26644* #
NASA-CR-152380 ..... N81-26076* #
NASA-CR-159385 ..... N81-26157* #
NASA-CR-159998 ..... N81-26529* #
NASA-CR-160019 ..... N81-26317* #
NASA-CR-161009 ..... N81-26169* #
NASA-CR-161010 ..... N81-26531* #
NASA-CR-161012 ..... N81-26530* #
NASA-CR-161013 ..... N81-26749* #
NASA-CR-161014 ..... N81-26750* #
NASA-CR-161763 ..... N81-26557* #
NASA-CR-161807 ..... N81-26164* #
NASA-CR-161808 ..... N81-26165* #
NASA-CR-161809 ..... N81-26276* #
NASA-CR-161810 ..... N81-26746* #
NASA-CR-161811 ..... N81-26275* #
NASA-CR-161812 ..... N81-26747* #
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NASA-CR-164090 ..... N81-26516* #
NASA-CR-164094 ..... N81-26517* #
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NASA-CR-164097 ..... N81-26519* #
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NASA-CR-164109 ..... N81-26521* #
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NASA-CR-164111 ..... N81-26523* #
NASA-CR-164123 ..... N81-26525* #
NASA-CR-164260 ..... N81-27032* #
NASA-CR-164262 ..... N81-27031* #
NASA-CR-164266 ..... N81-26528* #
NASA-CR-164373 ..... N81-26527* #
NASA-CR-164375 ..... N81-26524* #
NASA-CR-164420 ..... N81-26168* #
NASA-CR-164421 ..... N81-26430* #
NASA-CR-164475 ..... N81-26117* #
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NASA-CR-164477 ..... N81-26155* #
NASA-CR-164478 ..... N81-26594* #
NASA-CR-164479 ..... N81-26260* #
NASA-CR-164480 ..... N81-26554* #
NASA-CR-164481 ..... N81-26555* #
NASA-CR-164506 ..... N81-27029* #
NASA-CR-164513 ..... N81-26028* #
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NASA-CR-164516 ..... N81-26031* #
NASA-CR-164517 ..... N81-26032* #
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NASA-CR-164522 ..... N81-26778* #
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NASA-CR-165215 ..... N81-26491* #
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NASA-CR-165310 ..... N81-26075* #
NASA-CR-165332 ..... N81-26177* #
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NASA-CR-166194 ..... N81-26116* #
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NASA-TM-82142 ..... N81-26643* #
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NASA-TM-82608 ..... N81-26145* #
NASA-TM-82622 ..... N81-26459* #
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NASA-TM-82632 ..... N81-26236* #
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NASA-TM-82634 ..... N81-26844* #
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NASA-TM-83112 ..... N81-26148* #
NASA-TM-83128 ..... N81-26083* #
NASA-TM-83131 ..... N81-26274* #
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NASA-159306 ..... N81-26157* #

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NBS-SP-500-75 ..... N81-26760 #
NBS-SP-578 ..... N81-26223 #

NBS-TN-1029 ..... N81-26974 #

NBSIR-78-1580 ..... N81-26222 #
NBSIR-80-2005 ..... N81-26730 #
NBSIR-80-2154 ..... N81-26765 #
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NOAA-80123102 ..... N81-26548 #
NOAA-80123107 ..... N81-26691 #

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NORDA-TN-81 ..... N81-26687 #
NORDA-TN-84 ..... N81-26686 #
NORDA-TN-92 ..... N81-26688 #

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NPS55-81-007 ..... N81-26783 #

NRL-MR-4405 ..... N81-26888 #
NRL-MR-4437 ..... N81-26920 #
NRL-MR-4459 ..... N81-26441 #
NRL-MR-4474 ..... N81-26860 #
NRL-MR-4491 ..... N81-26919 #
NRL-MR-4499 ..... N81-26150 #
NRL-MR-4501 ..... N81-26676 #
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NSF/RA-800374 ..... N81-26507 #
NSF/RA-800385 ..... N81-26641 #
NSF/RA-800386 ..... N81-26979 #

NTIA/REPT-80-45 ..... N81-26316 #
NTIA/REPT-80-47 ..... N81-26355 #

NTIA/SP-80-10 ..... N81-26357 #

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NUSC-TD-6399 ..... N81-26171 #

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OWRT-A-078-NEV(1) ..... N81-26545 #
OWRT-A-084-NEV(1) ..... N81-26543 #
OWRT-A-103-ILL(1) ..... N81-26428 #

OWRT-B-110-ILL(1) ..... N81-26224 #

OWRT-C-90261-D(9521)(1) ..... N81-26225 #
OWRT-C-90293-T(9629)(1) ..... N81-26613 #

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PB81-152357 ..... N81-26976 #
PB81-152688 ..... N81-26758 #
PB81-153405 ..... N81-26548 #
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PB81-153603 ..... N81-26681 #
PB81-153736 ..... N81-26542 #
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PB81-159139 ..... N81-26620 #
PB81-159345 ..... N81-26764 #
PB81-159394 ..... N81-26615 #
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PB81-160012 ..... N81-26289 #
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PB81-160798 ..... N81-26084 #
PB81-160806 ..... N81-26991 #
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PB81-167645 ..... N81-26730 #
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PNL-SA-8290 ..... N81-26871 #
PNL-SA-8503 ..... N81-26577 #
PNL-SA-8602 ..... N81-26282 #
PNL-SA-8603 ..... N81-26216 #
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PR-316 ..... N81-26745* #

PSAD-80-50 ..... N81-26149 #

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QMC/EP-1034 ..... N81-26122 #
QMC/EP-1035 ..... N81-26124 #
QMC/EP-1038 ..... N81-26123 #

QPR-2 ..... N81-26519* #
QPR-3 ..... N81-26518* #

QR-2 ..... N81-26520* #
QR-3 ..... N81-26212 #
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QR-5 ..... N81-26522* #
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RADC-TR-80-300 ..... N81-26337 #
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RADC-TR-81-87 ..... N81-26396 #

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RR-188 ..... N81-26767 #

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R80-2(536) ..... N81-26298 #

S-2899 ..... N81-26395 #

SAI-TR-04-165-5 ..... N81-26353 #

SAI-81-221-WA ..... N81-26850 #
SAI-023-81-110LJ ..... N81-26927 #

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SD-TR-81-35 ..... N81-26432 #

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SR-PO-04023-VOL-2 ..... N81-26528* #

SRI-MP-81-82 ..... N81-26863 #

SSC-300 ..... N81-26469 #

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SU-IPR-831 ..... N81-27030 #

SU-JIAA-TR-19 ..... N81-26417* #
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SU-SOL-81-3 ..... N81-26805 #

SU-STAN-CS-80-830 ..... N81-26803 #
SU-STAN-CS-81-841 ..... N81-26804 #

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SU-SUIPR-839 ..... N81-27029* #
SU-SUIPR-844 ..... N81-27031* #
SU-SUIPR-845 ..... N81-27032* #

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TR-2-53020/IR-52726 ..... N81-26075* #
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TR-556 ..... N81-26351 #
TR-0081(6610)-1 ..... N81-26442 #
TR-0081(6724-01)-1 ..... N81-26347 #
TR-0081(6940-01)-5 ..... N81-26443 #
TR-0081(6960-05)-4 ..... N81-27033 #
TR-0081(6970-02)-1 ..... N81-26432 #
TR-0581-0980 ..... N81-26169* #

TRB/TRR-780 ..... N81-26307 #

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TRW-34309-6001-RU-01-VOL-2 ..... N81-26176* #
TRW-34645 ..... N81-27028* #

TSC-USCG-80-7 ..... N81-26463 #

TSR-41 ..... N81-26350 #

UCB/EERC-80/18 ..... N81-26304 #

UCLA-ENG-8197 ..... N81-26754 #

UCRL-53116 ..... N81-26914 #
UCRL-83375 ..... N81-26931 #
UCRL-84167-REV-1 ..... N81-26215 #
UCRL-84419 ..... N81-26981 #
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UCRL-84992 ..... N81-26445 #
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UCSD/AMES/TR-80/002 ..... N81-26303 #

UDR-TR-80-83 ..... N81-26499 #

UILU-WRC-80-0153 ..... N81-26224 #
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US-PATENT-APPL-SN-017887 ..... N81-26358*
US-PATENT-APPL-SN-051271 ..... N81-26359*
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US-PATENT-APPL-SN-122965 ..... N81-26431*
US-PATENT-APPL-SN-122967 ..... N81-26179*
US-PATENT-APPL-SN-154663 ..... N81-26073* #
US-PATENT-APPL-SN-172727 ..... N81-26360*
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